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ANAXAGORAS
AND
THE BIRTH OF
PHYSICS

A HISTORY OF PHYSICS:
Its Concepts, Methods, and Theories

Under the Editorship of

Daniel E. Gershenson
and
Daniel A. Greenberg

SERIES I
NATURAL PHILOSOPHY BEFORE ARISTOTLE

ANAXAGORAS AND THE BIRTH OF PHYSICS

By Daniel E. Gershenson
and Daniel A. Greenberg

with an introduction by
Ernest Nagel

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To Our Parents

A NOTE ON THE ROLE OF *A HISTORY OF PHYSICS* AND ON ITS SCOPE

Physics has always been an important part of human thought. Even before science existed, as we know it today, people studied the world around them with great interest. Early written records show flourishing activity in the description and recording of natural as well as human events. Phenomena were correlated, one occurrence explained in terms of another or in terms of theoretical constructs, and the knowledge so gained applied to dealing with the environment. Compendia, tables, handbooks, encyclopedias, and almanacs were composed to enable the readers to understand nature, to predict its behavior, and to avoid its ravages or control its vagaries. Knowledge of nature was not separated from other kinds of knowledge; rather, it formed as essential part of all human thought.

Gradually men became committed to the idea that nature behaves in an orderly manner comprehensible to the mind. Explanations in terms of erratic behavior—analogous to the seemingly capricious behavior of human beings—were abandoned. Instead, people expected to find order underlying all phenomena. The precise definition of 'order' was, and still is, subject to change. But at all times it was assumed that order implies rational behavior; and the latter, in turn, was described in terms of logic and mathematics. The story of the attempt to conjoin rational explanation with perceived phenomena is the story of natural philosophy throughout the ages.

As the science which deals with the fundamental laws governing nature, physics provides the basic principles, methods, and concepts upon which all other sciences have built. Thus, a thorough understanding of biological and physical science has invariably entailed a knowledge of the basic concepts of physics. Indeed, all systems of human thought which have attempted to cope with observable phenomena have always had to take some notice of the results of current physical investigations. And the entire benefit derived from technology can be directly traced to advances made in physics.

Physics has always been connected with social and ethical theory and practice. The general conclusions of physics concerning the structure of the universe and the nature of rational thought inevitably have a profound influence on the way people act towards other people.

Furthermore, terms used in natural philosophy appear also in moral and social philosophy, and the physical theories containing these terms have often been made to apply to human situations.

Physics has also consistently demanded the attention of society. The activities involved in the investigation of the physical world as well as the time to engage in these activities have always required encouragement and financial support, and the degree to which science prospers depends directly upon the value attached to it by society. The twentieth century has seen a tremendous and sudden increase in the proportion of public resources devoted to projects undertaken by physicists. This support has become a matter of policy everywhere and demands decisions by citizens who must know what the decisions are about.

Thus, in order to understand fully any of the areas on which physics has impinged at any given time, one must know the state of physics at that time. Indeed, the importance of physics has been as great as the role the observable world has played in human life and thought.

Most of all, it is important for the *physicist* to have a thorough understanding of the development of physics.

Physics is not a deductive science, even though at any time the current theories may be displaced as derived deductively from a set of basic axioms. Physical theories derive from the union of observation and analysis. In order to arrive at a physical theory, three elements are required: data based on observation and experiment; an idea of the form that the final explanation will have (e.g. a qualitative or a quantitative statement, an algebraic or a differential equation, etc.); and an insight which fashions the data into a particular pattern of the desired form. At least one of these three elements must be new if the theory is to be original.

If only the conclusions of an investigation are learned and if only the theories currently accepted as true are known, there can be no understanding of the way physics advances. On the other hand, a historical account of the means used to arrive at new theories can give the physicist of today access to experience accumulated by generations of physicists who preceded him. With this experience at his disposal, he will have before him a greatly increased variety of methods and concepts and insights to call upon in his work.

Again, it is necessary for anyone engaged in research to be able to distinguish the new in his field from the old. It has often happened that an idea current at an earlier time has been represented later as being an original discovery, almost always through ignorance of earlier work. Ground already covered had to be gone over again while new fields were left waiting. Such backtracking can be avoided only if it is clear how earlier scholars arrived at their results and what these results were.

Finally, the best way to ensure that physical concepts can be worked with easily and revised freely is to present them in their historical context. Study of the development of a theory brings a familiarity which makes the material less formidable. The aura of sudden revelation is removed—that mystery which surrounds physical laws baldly stated—and theories can be understood as the product of human minds very similar to one's own. Only then can the physicist hope to work with the theories of others as freely and as intimately as with his own thoughts. An investigation into the history of physical concepts is therefore a necessary part of the education of a physicist.

These are the reasons we have undertaken a comprehensive history of physics which treats in detail some twenty-five hundred years of activity. Because this history is intended for laymen as well as professional scientists, it is to be written in a style which makes it accessible to a wide audience.

In treating the material, three paths are open. It is possible to trace each important concept in physics from its origin to its early disappearance or its current, accepted form. Or else each historical period can be dealt with as a unit, embracing the developments in all the fields of physics together and emphasizing the "spirit of all times" which supposedly gave birth to the physical theories characteristic of each period. The third way open is to study the men who have created physics through the ages. This is the path we have taken. For men make physics, and in the mind of man lies the origin of physical theories, as far as we can see. After all external influences have been taken into account, the individual physicist's way of looking at the world is what finally determines the way he explains the world. Indeed, the scientist of today would hardly find useful a historical account which fragments the total world picture formed in the mind of each of his predecessors.

The arrangement of the studies is chronological. We have made room, too, for surveys of eras once the contributions of individuals who lived during those eras have been elucidated. But the emphasis throughout the HISTORY is on the thought of each of those physicists who have made important original contributions to the field.

A HISTORY OF PHYSICS comprises five Series. The Series are entitled:

I. Natural Philosophy before Aristotle
II. Physics from Aristotle to Galileo

III. Physics from Galileo to Newton
IV. Physics from Newton to Einstein
V. Physics in the First Half of the Twentieth Century

January, 1962
New York

THE EDITORS

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Introduction

Most natural scientists today give little serious attention to the historical development of even their own special disciplines, and many of them regard the history of science as hardly more than an otiose preoccupation with erroneous views which were once current in now outdated sciences. It would indeed be difficult to justify the study of that history as indispensable for a successful career in natural science. Nevertheless, even if one discounts completely the possible value of such a study as a source of suggestions for resolving problems under present inquiry, as a convenient pedagogic approach for presenting modern scientific conceptions to beginners, or as a clue to the explanation of the character of civilizations different from our own, its potential utility to practicing scientists is still considerable.

For an analytic history of science can supply an enlightening perspective for viewing current scientific beliefs and examining them critically. It can do this by making evident some of the preconceptions that controlled scientific investigations in the past, and thereby directing attention to tacit assumptions underlying our own scientific convictions and procedures; by presenting various substantive as well as methodological notions that proved to be inadequate or mistaken when employed in earlier inquiries, and thereby enabling us to recognize more easily limitations in our own conceptions or to avoid with less difficulty similar errors; and by indicating the variety of ways in which scientific ideas are subtly transformed when their range of application is extended or otherwise modified, and thereby helping us to appreciate the flexibility of our own intellectual constructions as well as to guard ourselves against misleading myopic interpretations of our theoretical formulations. At its best, the history of science is an enterprise which can liberate us from a provincialism in thought that is not even aware of the possibility of alternatives to the scientific conceptions currently held to be fundamental; and while its study may be of no aid in solving technical scientific problems, familiarity with it can enlarge the scientist's angle of vision.

In any event, men have long been aware that the fortunes of mankind are intimately related to its understanding of natural processes; and although the investigation of the historical growth of such understanding has acquired the status of a distinct professional discipline only recently, interest in it is almost as old as is systematic scientific inquiry. However, the writing of an adequate analytical account of the development of scientific ideas makes large demands upon the historian. Ideally at least, he must possess not only the customary equipment of historical scholarship, as well as have the linguistic and other skills requisite for examining and evaluating the pertinent records of the past, but he must also be sufficiently proficient in the relevant branches of substantive science, as well as have a mature competence in the analysis of ideas, to enable him to appreciate the technical importance and the logical interrelations of the conceptual innovations and changes upon which he is reporting. It is therefore not surprising that the outstanding contributions to the history of natural science have in the main come from students who, like Ernst Mach and Pierre Duhem, had a thorough training in some branch of science and were at the same time sensitive to the logical issues involved in scientific inquiry.

These ideal requirements for a historian of science are not commonly embodied in a single individual, particularly in areas of study such as ancient science where, partly because of the increasingly specialized character of the preparation necessary for many modern learned professions, the scholarly and linguistic skills needed for competent research in those areas are only infrequently coupled today with a comparable scientific and philosophical competence. However, the intellectual equipment of a single student can sometimes be joined to that of another, to produce a work of significant scholarship which neither of them could perhaps achieve single-handed.

This possibility is brilliantly illustrated by the first fruit of the collaboration between Dr. Gershenson, a classical scholar and Dr. Greenberg, a theoretical physicist. Their combined professional training and experience obviously qualifies them to present an authoritative and penetrating analysis of the thought of Anaxagoras—although only someone who is himself a classical scholar, which I am not, is competent to assess in detail their interpretations of the fragmentary documents relating to Anaxagoras that have come down to us from antiquity, or their admittedly controversial evaluations of the extensive secondary literature on the subject. It is refreshing as well as illuminating to read an account of an ancient thinker's efforts to understand the physical world which is written, as the authors note in their Preface, "from the point of view of a scientist surveying the work of a distinguished colleague of a past age who was concerned with questions very much alive today." Their expert familiarity with the great organizing ideas of modern physics enables them to recognize and make explicit the seminal principles still being exploited that Anaxagoras employed in his investigations. In consequence, unlike many accounts of Anaxagoras, they present his ideas not as a scarcely intelligible jumble of unsupported speculations, but rather as components in a unified theory of natural phenomena for which he believed he had reasonably good observational evidence. On the other hand, their disciplined classical scholarship prevents them from committing the tempting fallacy of seeing in Anaxagoras' conceptions only what contemporary science regards as credible; and they indicate lucidly just how his assumptions differ from those currently accepted as valid, and why some of the former have proved to be unsatisfactory. Their book certainly testifies to the fact that collaboration between students with different but complementary professional training can produce clarifying works of historical reconstruction which, like many products of the mingling of different races and cultures, are distinguished by creative vitality and a sound originality.

Accordingly, the discussion of Anaxagoras presented in this book can not but fascinate the reader with a lively interest in the adventure of ideas. But the book also holds out great promise for the quality to be expected of further installments in the vast project upon which its authors are embarked to present in full the physical thought of antiquity. May this first issue of their collaboration serve as an example not only to themselves in their further inquiries, but to other explorers of the history of science as well.

Ernest Nagel

Columbia University
August, 1962

Preface

Anaxagoras was the first thinker of repute who was a scientist in the sense in which we use the term today. This book is a study of his theories and methods. It is divided into three main sections: Part I is an account of Anaxagoras' natural science; Part II consists of translations of all the ancient sources which mention Anaxagoras; and Part III is a discussion of these sources, as well as of the attempts made in modern times to understand Anaxagoras' thought.

Part I brings all that we know with reasonable surety about Anaxagoras and his scientific doctrines. The material is presented from the point of view of a scientist surveying the work of a distinguished colleague of a past age who was concerned with questions very much alive today. The account is necessarily incomplete and in places somewhat fragmentary. This is primarily due to the fact that Anaxagoras' writings have long been lost, so that we must rely exclusively on partial accounts and random mentions in other writers.

In Part II every reference to Anaxagoras by name in ancient literature is brought in full, in order that the reader may become familiar with the tradition and form his own judgments on it at his ease. We have avoided controversies surrounding the authorship of many of the works which have come down to us from antiquity and have, in general, ascribed each work to the author claimed for it in the manuscripts. The sources appear in English translation, to make them accessible even to those who are not acquainted with the original languages. Although many works represented have been translated before, we saw fit to make new versions of all passages which deal with Anaxagoras because the existing translations were, we felt, for the most part not entirely adequate. In some instances, notably in the case of the commentaries on Aristotle, the translations brought here are the longest connected passages from these works ever rendered into a modern tongue.

The sources are brought in chronological order, beginning with the earliest testimonies to Anaxagoras from the fourth century B.C.E. and ending with sources from the latter part of the sixth century C.E. The passages from each author are grouped together, and the chronological order in the case of authors contemporary with one another is of necessity somewhat arbitrary. However, the arrangement will allow the reader to see for himself how succeeding generations viewed Anaxagoras and his work.

In Part II it has been necessary to include material about Anaxagoras written a thousand years after his death because the most authoritative source for his doctrines is often held to be the direct quotations from his writings brought by Simplicius (sixth century C.E.), and this source can not be properly evaluated without the historical perspective afforded by a survey of the entire ancient tradition about Anaxagoras. Accordingly we have felt it necessary to gather every mention of Anaxagoras written in the period which falls between these chronological limits. Of course, any attempt to be exhaustive is liable to fall short of its goal, and we will be grateful to anyone who draws our attention to passages which have been missed.

There are references to Anaxagoras in certain ancient or medieval works whose date can not be determined because they are not ascribed in the manuscripts to any identifiable author. The largest class of these consists of anonymous scholia and commentaries. They may in fact date back to a time which lies within the chronological limits we have chosen, but any given statement in them can not be dated earlier than the manuscript on whose margins they appear. Since all scholia which mention Anaxagoras appear in manuscripts written after the sixth century, we have not included this material in Part II. The works containing references that we have omitted are: the *Dissoi Logoi;* the commentaries on Aratus preserved in the scholia, including the so-called fragments of the commentary of Achilles; the anonymous fragments of commentaries on Plato's *Phaedo* published in Norvin's edition of Olympiodorus' commentary on the same dialogue, listed in the Bibliography to the Sources; the scholia on Aelius Aristides; the scholia on Apollonius of Rhodes; Marcellinus' biography of Thucydides; the scholia on Homer; the scholia on Aeschylus; an *anecdotum* in a manuscript at Munich (*Codex Monacensis* 490, f. 483V); and the *Theologumena Arithmeticae.*

In Part III various aspects of the traditions, ancient and modern, about Anaxagoras are considered. In the first chapter our own attitude towards the sources is made explicit. This chapter and the next one present in some detail an evaluation of the source material brought in Part II, since the footnotes to the sources contain only remarks necessary to make the text comprehensible. The second chapter of Part III describes how certain traditions about Anaxagoras developed, as accounts of his life and work were transmitted from generation to generation. The third chapter of Part III gives the arguments which have led us to reject the so-called fragments of Anaxagoras' writings as a source for reconstructing his theories. Finally, the fourth chapter contains a descriptive bibliography of books and articles written on Anaxagoras during the last three hundred years.

Except in a few cases, we have refrained from attacking views which differ from ours, in order to spare the reader many dull pages of lengthy argument and counter-argument. The scholar of Anaxagoras, however, will easily detect the polemical side of our writings, as will anyone who compares the material in Part III, Chapter 4 with the rest of the book.

In this book we have not studied the relationship between Anaxagoras and other thinkers who preceded him, were contemporary with him, or came after him. Mutual influences, both broad ones and ones limited to the formulation of specific theories, surely exist, and they will be discussed in a later volume of this series which will survey the entire history of natural philosophy before Aristotle. In the present volume, however, we have concerned ourselves only with Anaxagoras' natural philosophy, taken as a coherent system of thought capable of being described in its own right.

It is necessary to disgress briefly to discuss the two major works of Hermann Diels, *Doxographi Graeci* (3rd ed.; Berlin, 1958: photocopy of first ed., Berlin, 1879)—hereafter referred to as DG—and *Die Fragmente der Vorsokratiker* (herausgegeben von Walther Kranz, 9th ed.; Berlin, 1960. First ed.; Berlin, 1903)—hereafter referred to as VS. These books have dominated the field of presocratic scholarship for more than half a century and we would like to explain why they will hardly be mentioned in this book. There are three points we wish to discuss: (1) We do not subscribe to the conclusions reached in DG; (2) We disapprove of VS; and (3) even if DG and VS are accepted at face value, the two books inherently contradict each other.

(1) The main conclusions reached by Diels in DG concern the transmission of information about presocratic philosophy to later generations in antiquity. In the introduction Diels begins from a consideration of the *doxographi graeci,* ancient Greek textbook writers of the history of philosophy (e.g. Plutarch, Galen, and Stobaeus), who obviously copied large quantities of material from their predecessors. He then generalizes on the basis of a detailed study of style and wording to the conclusion that virtually all that was ever written in antiquity on the subject of presocratic philosophy goes back to a single book, unfortunately lost, composed by Theophrastus. This is not the place to discuss Diels' arguments in detail; we shall do this at length elsewhere. Here it is enough to relate Diels' explanation for the wide divergences, the rank confusions, and the blatant contradictions in the ancient textbooks' accounts of presocratic philosophy. Diels assumes

that many copies, précis, and expansions—virtually all of which are entirely lost—were made of Theophrastus' book; that these copies, etc., in turn spawned others; and that this process continued for many generations. In this way there was produced a complicated, highly ramified genealogy on which every work of ancient literature on the subject could presumably be located. Diels himself never drew up a table of the exact relationships between these textbook accounts, extant and lost, and it is an interesting commentary on the clarity of Diels' arguments that no two of the "genealogical tables" compiled by Robin, Capelle, Burnet, and others, agree, though they all purport to give in tabular form the results of the investigations in DG. What vitiates Diels' work is his underlying, tacit assumption that textbook writers do nothing but copy from earlier texts, usually from only one or two, without making any significant changes in the text they have before them and without ever adding anything substantial of their own. Once this hypothesis is called into question, many of Diels' results become subject to review.

Despite this peculiar hypothesis of Diels', the over-all picture which emerges from DG is much the same as it would have been on any reasonable assumption concerning the tradition: distortions, mistakes, and obfuscations increase as time goes on and traditions grow and develop. For then as now, in each generation, men certainly wrote new books based on the literature available to them, adding, subtracting, and in general handling the material as they wished. Thus, the really important point which emerges from Diels' DG, as it would from any study of the tradition, is that the tradition about Anaxagoras became filled with errors and that these errors got worse as time went on. This in turn means that the only way to deal with the textbook accounts of Anaxagoras is to arrange them chronologically—something Diels and his successors never did—and to consider them reliable in proportion to their proximity in time to Anaxagoras. (See Part III, Chapter 1.)

DG aroused virtually no controversy when it appeared, and virtually none since, in marked contrast to the reception accorded to similar textual studies on Homer and on the Bible. Diels' general methods and conclusions were never challenged; indeed they were accepted immediately as incontrovertible, often to the accompaniment of lavish praise for the scholarly acumen displayed in the 250-page Latin introduction to DG. The only way to explain this is to assume that since Diels no one has had the personal involvement, the patience, and the tools to study in detail the ancient textbooks of philosophy, even though the unsatisfactory nature of the conclusions reached in DG cry out for not one, but many new studies of the entire problem.

(2) Diels' second great work, VS, was the logical sequel to DG, for

VS brought to its acme the textbook tradition begun in antiquity and continued without interruption to the present. In VS, each of the presocratic philosophers was taken individually, and many ancient accounts concerning the lives and doctrines of each of them were brought together, with their authors duly noted. These selections were for the most part kept brief, and the choice of sources as well as of the amount of the context quoted in each instance was made according to purely subjective criteria. The sources were arranged for the most part according to topics under each philosopher, but within each of these sections no chronological order was maintained; instead, the testimonies were brought in an order determined by no discernible method.

The history of VS is no less interesting than that of DG. As soon as it was published it became the standard reference book for studies in presocratic philosophy. A few faint murmurs of protest greeted the first edition, from people who objected that Diels had not been exhaustive and had put in only selected sources (for example, practically nothing was brought from the extensive commentaries of Alexander and Philoponus on Aristotle); but these protests were curtly dismissed by Diels in the preface to the second edition, where he assured his readers that he had carefully separated the kernels of grain from the chaff—a boast rarely challenged since. In fact, practically every study made of Anaxagoras since the appearance of VS has limited itself exclusively to the selections brought by Diels in VS.

We find VS to be a dangerously misleading book, and we think that presocratic studies will improve in quality as the use of VS becomes rarer. We find its selection inadequate; the extent of the citations it brings as testimony arbitrary; its lack of historical and chronological sense prejudicial to its claim to authority; and most of its pretension to present genuine fragments of the original writings of the philosophers almost totally unfounded. All these points will emerge clearly from the following pages for the case of Anaxagoras.

(3) Finally, Diels must receive censure for misleading the scholarly world in a very serious way; for the confidence placed by scholars in these two books was to a large degree based on the fact that both were written by the same man, while in fact the two works stand in fundamental contradiction to each other. In DG Diels' primary concern is with problems of chronology. He expends all his efforts on the attempt to rid late, corrupt, and contaminated texts of the errors which have crept into them in the course of time; and even then he absolves himself of any responsibility for failure with the contention that the texts are sometimes so confused that it is impossible to do more than suggest a tentative reconstruction. Thus the dubiousness of the later sources underlies all the work in DG. In VS, on the other hand, all concern

with chronology seems to have vanished. The problems which called forth DG, and the intractability of the material which served there as a guarantee against responsibility for errors, are now forgotten. Instead, in VS testimonies from authors separated by as many as *fifteen centuries* are thrown together without the slightest indication of who is to be taken as more reliable; with the result that they have always been taken to be a priori equally reliable. Diels must bear the responsibility for the confusion subsequent upon this state of affairs, and for the fact that the premise of DG, that accounts become more corrupt as time goes on, is nowhere applied in VS. It is amazing that this fundamental inconsistency escaped Diels.

Our conclusions, then, can be summarized as follows: We do not subscribe to most of the detailed conclusions of DG, and find that the entire subject matter covered therein must be restudied in detail; and we reject the use of VS as a source book for presocratic studies, and call for a return to the sources, and a thorough study of all the ancient testimony, chronologically arranged, and with enough of the context in each case to make the meaning clear. So much for this digression.

We wish to thank our teachers and colleagues, as well as many students in the Departments of Greek and Latin and of Physics in Barnard College and Columbia University, whose interest and sympathy has been a source of encouragement to us throughout. We are especially grateful to Professor Saul Lieberman of the Jewish Theological Seminary of America, whose students we have been for some three years. If there is merit in this book, much of it is due to our having learned in the course of our studies with him fundamental methods of dealing with ancient texts, as well as the basic frame of mind in which texts must be approached if antiquarianism and adumbrationism both are to be avoided. To Professor Ernest Nagel of Columbia University we are deeply indebted for his interest in our work from the beginning of our collaboration, for his support and encouragement, and for his willingness to write the Introduction to this book.

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Daniel E. Gershenson
Daniel A. Greenberg

New York
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ABBREVIATIONS PAGE

B.C.E.	Before the Christian Era
C.E.	The Christian Era

The following abbreviations are used for the standard collections of classical texts:

BT	*Bibliotheca Teubneriana*
Budé	*Editions Budé* of *La Societe d'Editions "Les Belles Lettres"*
LCL	Loeb Classical Library
OCT	Oxford Classical Texts

All other abbreviations used in this book are standard abbreviations.

NOTE

The modern works referred to by a number in parentheses following their author's name can be found listed by title under that number in the Bibliography of the Modern Literature. References to numbered sources are to the translations in Part II.

Part One

Anaxagoras and the Birth of Physics

They say that Anaxagoras was once asked . . . , "Why should anyone choose to be born rather than never to come into the world?" to which he replied, "For the sake of contemplating the universe and the order governing its parts."

Aristotle *Ethics* [*Called after Eudemus*] 1216a11-14 (source 83)

Chapter One

ANAXAGORAS' LIFE AND TIMES

The emergence of scientific inquiry as we know it today is almost impossible to trace. People have always wondered about the behavior of things around them. From earliest times human activities have been determined by the succession of night and day, winter and summer, rainy and dry seasons, growth and decay, life and death. Thoughtful men were always concerned with the nature of these phenomena and sought explanations for them.

For a long time "scientific" activity proceeded along various paths. Some people collected and organized vast amounts of empirical data, investigating all sorts of correlations between events and recording their findings in almanacs, books of augury, and astronomical tables, which were the first great scientific handbooks. Others devised means to control their surroundings, developing technologies of agriculture, manufacture, and commerce. And where they failed in their efforts to provide for the future on the basis of correlations with the past, or to control nature directly, many people tried with sacrifices, prayers, vows, magic, and ritual to move the living powers they saw behind natural occurrences, powers which appeared sometimes capricious and sometimes rational, sometimes benevolent and sometimes destructive.

All these activities led to increased knowledge, technology, and understanding, but despite this progress, that particular indefinable combination of observation, experiment, and reason which we today associate with scientific activity does not seem to have been present to any considerable extent in Western societies before the fifth century B.C.E. Although the origins of science reach back into prehistoric times, and its "beginnings" remain—and perhaps will forever remain—undiscovered, the emergence of natural philosophy as an experimental and theoretical pursuit in a form fundamentally the same as its present one can be said to have occurred in the Hellenic world at about the same time that the last of the prophets were preaching in Israel and the first consuls were ruling in Rome. The first natural philosopher (in the present sense of the term) whose name is known to us, whose system has been preserved, and whose fame as the founder of the new natural philosophy was celebrated throughout antiquity,[1] was Anaxagoras.

Anaxagoras was born in Ionia, the western coastland of present-day

Turkey, about the year 500 B.C.E.[2] He was a native of the city of Clazomenae,[3] a thriving port on the shores of the Aegean sea. As the son of the wealthy Hegesibulus[4] he doubtless had ample time and leisure in his early youth to pursue his studies and to learn the philosophical theories current in his day.

At the time of Anaxagoras' birth, Athens was taking its place as one of the leading cities in the world. Twice in ten years she defeated the Persians, who had embarked on punitive expeditions against her: in 490 B.C.E. the expedition of Darius was halted on Athenian territory at Marathon, and Athens emerged as a considerable military power; in 480 B.C.E. victory in the naval battle off Salamis established Athens, under the leadership of Themistocles, as the greatest maritime power in the world. In cultural matters too Athens came to be first among the Greeks. Painting, sculpture, architecture, music, drama, mathematics, logic, rhetoric, and natural philosophy all flourished within her walls.

Anaxagoras came to Athens when he was about twenty years old. He was immediately accepted into the highest circles, numbering even Themistocles among his associates.[5] His brilliance attracted many students,[6] the most distinguished of whom was Pericles, political leader of Athens at the acme of her greatness, from 454 to 431. Later, when Pericles' fame had spread over the world, the close relationship between teacher and student became famous too. Pericles openly acknowledged his indebtedness to Anaxagoras, and the latter came to be known everywhere as the instructor of Pericles.[7]

Not only did Anaxagoras transmit his teachings orally to students who came to hear him, but he also prepared a written account of his physical theories and published it as a treatise on natural philosophy. The book soon became a standard text in Athens,[8] and we find Socrates too turning to Anaxagoras' book to learn the laws that govern the physical universe.[9] Anaxagoras' teachings were so well known that many of them were inserted into the dialogues of plays, either in a serious vein in tragedy,[10] or as material for lampoons in comedy.[11]

In addition to his intellectual achievements Anaxagoras possessed personal character traits which set him apart from his fellow men, and made him the archetype of the popular image of an "up-in-the-air" intellectual.[12] He completely renounced the ordinary pleasures and duties of everyday life and withdrew entirely from political affairs and from personal involvements.[13] Through neglect and inattention he allowed his ample inheritance to waste away.[14] Instead he gave himself over to his studies and immersed himself in his scientific investigations. He would often say that the sole purpose of life is to observe and ponder natural phenomena and to attempt to explain them rationally.[15] According to him, a life devoted to theoretical investigations—a life of retirement from practical affairs, of complete preoccupation with contemplating the heavens and with viewing the grand design of the universe—was the truly happy life, though to most people it seemed just the opposite.[16]

In fact Anaxagoras held that the experiences of day-to-day life have no intrinsic value at all, good or bad; for he believed that the significance of every situation depends entirely on the way one looks at it.[17] This belief led him to conclude that observation can furnish a true picture of physical reality only if properly analyzed. It also revealed a detachment of character reflected in the story later told of him that he received the report of his son's death calmly and without emotion, with the simple statement that he had known his son was mortal from the day of his birth.[18]

Thus the image Anaxagoras presented was that of a philosopher totally indifferent to matters of the flesh and consumed with a zeal for knowledge and for the pursuit of truth. Such an image easily lent itself in later ages to all sorts of legends and tales[19] and caused him to be cited often as an example in moralistic sermons for[20] and against[21] abstract philosophy.

Anaxagoras lived at Athens for about thirty years. It is not possible to trace his steps during the years following his departure from Athens. We find him last in the city of Lampsacus on the Asiatic coast of the Dardanelles, where he died when he was about seventy years old. The citizens of Lampsacus, eager to pay tribute to greatness in their midst, gave him a public funeral and continued to honor his memory for over one hundred years after his death.[22]

Anaxagoras' life spanned the golden age of Athens. He was the first natural philosopher of note to reside in Athens, the only one to remain there for any considerable length of time during its most flourishing period. His physical theories exerted a profound influence on scientific thinking there, and this influence still prevailed a century after his death.

Chapter Two

THE CONSTITUTION OF MATTER

The basic question which must be answered by any physical theory is: What is the nature of matter? Contained in this fundamental query are many other questions: What are the fundamental properties of the substances that make up the world around us? Is matter discrete or is it continuous? Must it all be perceptible to touch? What kind of changes does it undergo, and by what laws are these changes governed? What keeps objects together, and endows them with their properties? These questions faced Anaxagoras as they have faced physicists throughout history. The answers he gave and the methods he used to reach them allow us to appreciate the insight he achieved into the nature of matter.

In investigating these questions Anaxagoras employed two important and distinct methods,[1] each of which was undergoing separate development in his day. The first method consisted of careful and meticulous observation, by means of direct sense perception, of the phenomena which took place around him. Large numbers of events had to be studied, and a multitude of processes had to be followed in detail. Nothing at all could be omitted since at this nascent stage of science it was almost impossible to distinguish something important from something trivial, or something complex from something simple. On every new frontier this is so: within the domain which is as yet unexplored all avenues must be followed until there appears some pattern which serves to differentiate basic features from irrelevant or secondary ones. For Anaxagoras the new frontier was the whole of the physical world, and there was no part of it which escaped his careful attention; the stars at night and the sun by day, earthquakes and cloudbursts, the organic and the inorganic all were studied, all noted, and all somehow fitted into his emerging system. Beyond the scope of passive observation lay things which could be determined only by active interference with the natural course of events, so that the results of experimentation also found a place among his observations. True, the data he accumulated "passively" outnumbered that which he gathered through experiments, but this was only because the variety offered by nature itself was so great, so novel, and so little understood that it alone provided ample challenge to the investigator.

The second method Anaxagoras adopted in constructing his physical theories was the newly formulated method of logical analysis. Logic has always been used by people to organize their thoughts into patterns involving generally accepted axioms as well as modes of deduction which link one thing with another as antecedent and consequent. The rules have differed, and there has never been a universal consensus on just precisely what a system of thought must be in order to be "rational." Nevertheless it seems that there evolved, at least in the West, a fairly uniform concept of reason intuitively understood and used in everyday life. This intuitive concept first underwent careful review and development at the hands of Greek thinkers around the time of Anaxagoras. What they began to do was to lay down rules in an explicit, formal manner as rules of logical thought. There followed a period of development that culminated with Aristotle's famed treatises on formal logic, which served to summarize and extend two centuries of painstakingly wrought advances, some of which can be seen being forged in the probing studies of logic found in Plato's dialogues. Anaxagoras lived at a time when only the first strides had been taken, but he made full use of the results available to him.

These two methods were the basic tools used by Anaxagoras to study the nature of matter, and the nature of the physical universe as a whole. Indeed, the most important feature of Anaxagoras' theory is the simple fact that he employed both methods, that he insisted that all observations be fitted into a logical framework. It was he who first demanded that observation *and* logic join hands in natural philosophy; that neither take precedence over the other; and that where they seem to conflict they must be conjoined, harmonized, and even compromised, without either of them ever being abandoned. We will see many instances of Anaxagoras' attempts to achieve this harmony; but the real importance of these attempts is that they were made at all and that Anaxagoras never allowed his physics to fall wholly into the realm of abstraction and fantasy or to be bound entirely by the appearances perceived by the senses.

The data offered by the senses convinced Anaxagoras that the world around him was infinitely varied and that everything in it took part in never-ending processes of physical change.[2] There seemed to be no limit to the variety of objects that *can* exist and no limit to the variety of those that do actually exist in the universe. When a red object fades, it assumes successive shades of red and pink until all color has vanished; when a lump of sugar dissolves it undergoes continuous diminution until it finally disappears; when a piece of iron rusts away it passes through all the stages that lie between metallic hardness and powdery softness. The intermediate states through which any object passes in the course of change are innumerable, and any one of these states can be realized if the process is somehow stopped short.

In the course of time *all* perceptible objects undergo changes and transformations, which go on without end. Consider for example a burning log. Part of the log rises as smoke into the clouds; thence rain descends into bodies of water, in which salts and earthy precipitates form; from earth, mists rise into clouds, and out of earth there are formed stones too, which give off sparks that kindle flames that can again consume a log. Part of the log remains in the form of ashes, which crumble into earth and nourish the plants that grow from it; again, these plants nourish animals, whose fate it is to return once more to earth. If we chose to follow the burning log in detail through all the transformations of all its parts, it almost seems—as it seemed to Anaxagoras—that it would eventually pass through every state of every substance in the world; that it would, in short, encompass the sum total of all things that exist.

For Anaxagoras, then, infinite variety and never-ending change were everywhere characteristic of matter, and he set about to explain them in terms of the stable categories of scientific thought. In his eyes, continual variation and transmutation were omnipresent motifs in nature, and it was these that had to be rendered comprehensible through a set of discrete logical statements.

The fundamental law of logic which had gained widespread acceptance in Anaxagoras' time was the Law of Contradiction, which states that a proposition and its negation cannot be simultaneously valid, i.e. that it is impossible both to be and not be something at the same time.[3] This law has particularly interesting consequences when applied to the statement that some specific thing actually exists. For if we say of something that it really exists, that it really is, that existing can really and truly be predicated of it, and that existence is inherent in it, we can not say of the same thing that it does not exist; so that, inasmuch as a fundamental, inherent property is by definition permanently attached to the object it modifies, anything that really and inherently exists must exist for all time. The Law of Contradiction applied to the basic property of existence results in a kind of Law of Conservation of Existing Things, frequently repeated in Anaxagoras' time, which states that something *real* can not come out of nothing and that anything that really exists can not have been nonexistent in the past or be nonexistent in the future—that it can not ever not have been and can not ever disappear.

Of course, the Law of Conservation of Existing Things only becomes relevant in natural philosophy when it is decided how the law will be applied, i.e. when it is stated clearly just what it is that should be assumed really to exist. Different assumptions correspond to different ways of looking at the world. Sometimes these different assumptions may lead to different physical theories which give equally valid results; and sometimes they may lead to physical theories which yield incorrect results, in which case they must ultimately be abandoned. Anaxagoras had to make at the very outset a fundamental choice of what things he would take to be real, permanently stable, and eternally conserved in this world of continual change.

To most people the only things that are real are those objects they can touch, feel, and handle. For them the things that count are things that directly impinge on their senses and not abstract ideas or concepts. What exists in their view is *matter*, having weight, size, texture, color, taste, smell, temperature, and other such properties. Matter can not be conjured up, nor can any magic make it disappear; even when things wear away, they only turn into dust, and dust is no less matter than the original object was. Matter is stable; a mountain or a table is not here today and gone tomorrow. For most people, then, the Law of Conservation of Existing Things becomes a Law of Conservation of Matter, according to which different kinds of matter are eternal and suffer no diminution or addition. Anaxagoras accepted the view that matter is eternally conserved, though as we shall see he did not believe that it is the only thing which really exists.

On the basis of considerations to be discussed in detail in the next chapter, Anaxagoras chose organic substances having a certain set of inherent properties as the fundamental, basically real kinds of matter in his theory. These substances were what we today would call tissues, things like flesh, bone, blood, marrow, leafy matter, bark, etc. A full list was certainly never made, perhaps because the possibility of new discoveries in the field of biology was always felt to be present. Thus the number of different kinds of basic substance remained indeterminate and might even have been thought to be infinite. As for the basic properties belonging to these organic substances, these were taken to be one of each of the contrasting absolute qualities, such as (absolute) hotness and (absolute) cold. The number of these pairs of contrasting qualities was probably also not specified, and may well have been left open. In Anaxagoras' theory, then, there existed a number of elementary kinds of matter to which basic, discrete properties were permanently united. The amount of each kind of matter, together with all the properties belonging to it, was fixed once for all, and could not change through any interaction or under any circumstances.

It is noteworthy that in forming his picture of physical reality Anaxagoras took different kinds of matter *and* their different properties to be basically real and immutable. In this way he introduced three separate conservation laws into his physics: (1) a restricted law saying that the amount of each specifically characterized kind of matter is conserved (according to which, for example, the total amount of *hot, light, and sweet flesh* is conserved, the total amount of *cold, light, and sweet flesh* is separately conserved, and similarly for every kind of matter with every specific set of properties); (2) a broader law, following from (1), saying that the total amount of any kind of matter, regardless of qualities, is conserved (e.g. the total amount of all *flesh* is conserved); (3) a law parallel to (2), derived in a similar manner from (1), saying that the total amount of any particular absolute quality, regardless of the substances to which it is attached, always remains the same (e.g. the total amount of all different kinds of matter to which the property of *being cold* belongs always remains the same). In addition, of course, the general Law of Conservation of Matter, saying that the total amount of *all matter* taken together is conserved, was also true in Anaxagoras' theory, as it was taken to be true quite generally before him.

The fact that the elementary substances and qualities taken to be real and eternal by Anaxagoras were chosen from among the common everyday substances and qualities which we perceive all around us gives some measure of the degree to which Anaxagoras was committed to the reality of perceived phenomena, even while insisting on the role of logic in the formulation of his theory. To the question, "What really exists?" Anaxagoras replied that *things of the kind we perceive to be real* really exist. Thus Anaxagoras introduced into natural philosophy at the very outset a reluctance to depart from the generally familiar categories of macroscopic phenomena. This reluctance was to remain at the heart of physics for some twenty-five hundred years and to resist tenaciously all efforts to displace it. Anaxagoras would have nothing to do with a system which derives the perceived world from a set of primary entities which are inherently different in nature from those used to describe perceived phenomena. Until the twentieth century, succeeding generations of physicists (with some notable exceptions) for the most part concurred.

We see then that certain kinds of specifically characterized substances served as basic elements in Anaxagoras' picture of reality. In Anaxagoras' eyes however another element was no less real than these eternally immutable material components of the universe, and this element was *physical change*. This too had to be accounted for in a reasonable way within the theory.

Because the material components of reality could themselves undergo no change, the only kind of change Anaxagoras could allow was change resulting from the displacement and rearrangement of these components.[4] Qualitative change simply could not take place in the theory, since the basic qualities were permanent; for once Anaxagoras had admitted the reality of the basic properties of matter, these properties had to remain unchanging and immutably linked to matter. The only way left open to account for observed physical change was through rearrangement of the stable components of which the world was assumed to be composed.

Indeed, a glance around us shows that change of position is one of the most common kinds of change: a room changes its appearance when furnishings are shifted about; a house changes into a heap of rubble when its parts crumble to the ground; a city changes when wood and stone are brought from quarries and forests and made into buildings. Change of position, so familiar in everyday life, provided Anaxagoras with a way of explaining all physical change.

With Anaxagoras, then, the conviction that observed transformations from one state to another are real and not illusory entered physical science at the beginning of its development, side by side with the belief that the substance of the material objects undergoing change is itself permanent and immutable. The apparent contradiction between these two fundamental positions made it necessary to assume that what accounts for *all* change is change of position with time. This meant that the one property of matter which might alter from one moment to the next is the position it occupies in space. The position of an object is not, then, one of the object's inherently real properties; there is no Law of Conservation of Place. Instead, Anaxagoras took it to be perfectly possible for an object to move from one place to another as time flows on, and he believed that this motion could account for all the different kinds of change we see around us.

We are now in a position to understand the boldest step taken by Anaxagoras in formulating his theory concerning the constitution of matter. We have seen that Anaxagoras did not consider that he had only to account for change in a general way, but felt that he had to account specifically for the apparent emergence of an infinite variety of objects from any given object as time goes on, as well as for the apparent ability of an object to pass through the continuum of qualities which lies between the discrete absolute extremes of quality. The only way however that an infinite variety of stable entities can exist in a finite object is for the entities to be *infinitesimal in size*, because an infinite number of entities can be contained in a finite volume only if they are infinitely small. Anaxagoras realized that this is so and was thus led to postulate explicitly that the basic units of matter—the fundamental building blocks out of which all objects are made—are infinitesimal in size.[5]

Anaxagoras' concept of infinitesimals was carefully conceived and worked out. Anaxagoras knew, as was widely known in his time, that an infinite number of *points* could never make up an object of finite size; for a point has absolutely no extension (by definition), so that no finite number of points—and, by induction, no infinite number of points—can have extension either. On the other hand Anaxagoras also knew, together with his contemporaries, that an infinite number of objects each of which is finite in size must occupy a volume which is infinitely large. It was therefore clear that the size of the basic units of matter must be smaller than any finite size, but larger than the size of a point, i.e. that the basic units must be of infinitesimal extension, if an infinite number of them were to enter into the composition of each and every finite object.

The entities Anaxagoras called infinitely small were infinitesimal in precisely the sense in which the word has been used since the seventeenth century; they were magnitudes whose measure is larger than zero but smaller than any arbitrarily small number. Anaxagoras was to the best of our knowledge the first to introduce infinitesimals into a physical theory. It might be added that the difficulties which he and his successors encountered when using these new quantities were in no small measure responsible for the complete abandonment of infinitesimals in science and in mathematics for some two thousand years after his time.

Anaxagoras' theory was thus basically a molecular theory of matter.[6] It resembled molecular theories of later ages in that it pictured matter made up of stable particles having the same properties as matter in bulk; but it differed from all other such theories in the very important respect that the molecules were infinitely small and hence able to constitute a smooth continuum. This one big difference made it a simple matter for Anaxagoras to conceive that any object had in it at least some molecules of every substance possessing every quality;[7] and that an object assumed every intermediate quality between the extremes as the proportion of molecules possessing each of the discrete extreme qualities varied continuously.

In the next chapter we shall discuss Anaxagoras' specification of the elementary substances in his theory. But the specific choice of these substances was not as fundamental to his picture of physical reality as the conviction that among the basic elements of reality are eternally conserved kinds of matter, together with qualities, of the type we observe all the time, and changes and transformations of the type we perceive all around us. If we add to this his belief, based again on observation, that objects can exist in an infinite variety of states and that out of any object the entire infinite range of existing things eventually emerges, we arrive directly at his conclusion that physical reality is built out of an infinite number of molecules of infinitesimal size, none of them subject to change, but all of them free to move about from one place to another. This then was the starting point of Anaxagoras' physics.

Chapter Three

THE ELEMENTARY SUBSTANCES

The problem of identifying elementary substances and of distinguishing them from compounds which can be broken down into component parts having properties different from those of the original compound, is a problem that did not proceed smoothly towards solution until the nineteenth century. In order to differentiate between elements and compounds careful and precise observations must be made. In particular it must be determined with certainty that a substance which is taken to be elementary can not be decomposed, or undergo any process which yields different substances. The fact is that over the years various kinds of matter have been considered elementary, since the elementarity of a substance depends on the experimental conditions with reference to which elementarity is defined. For example, when methods of decomposition are used which can break only weak bonds of the kind which link macromolecules in biological structures, organic molecules appear to be the "elementary" components of all living things. When chemical interactions are employed in which higher energies are available to break the stronger bonds tying together organic molecules, atoms appear to be the "elementary" components out of which all things are formed. At higher energies, atoms decompose into electrons and nuclei; and at still higher energies, the nuclei in turn break up into components even more elementary. To a large degree, then, the distinction between what is simple and what is complex depends on the range of energy employed in the experiments being performed.

As long as sufficiently accurate measuring equipment had not been developed, and as long as energies greater than those attainable from fire or from strongly interacting chemicals had not been made available, the experimental scientist could at best hope to find the "elementary" building blocks of biology and chemistry, organic molecules or atoms. Under these conditions, the experimentalist could never obtain conclusive results because of the impurities almost always present in his substances, impurities which continually came to view with each new purification, and which could rarely be said with confidence not to be the decomposition products of the substance at hand. Thus before the nineteenth century the *theoretical* physicist, always eager to probe in his theories to the very foundations of physical reality, was forced to establish the distinction between elementary and composite substances in his theory not on the basis of clear-cut results arrived at through experimentation, but on the basis of other criteria. Anaxagoras chose life as the criterion of elementarity.

The distinction between the living and the non-living has always been obvious, for it is evident that there are things in the world which are alive, and other things which are not. The reason for this distinction is far from clear; nor has there ever been general agreement concerning the real basis for the distinction, i.e. concerning what it is precisely that characterizes life, and what functions are peculiar to living organisms.[1] The answers to these questions have been subjects of inquiry and debate from earliest times. On the other hand, the fact that the distinction exists has never been challenged, and every attempt to understand the physical universe has had to come to grips with this fact.

The prevalent view has taken the matter in the universe to be inherently devoid of life. In this view, organic substances are particular structured combinations of the inorganic; and living organisms are specially structured combinations of organic substances which are capable of performing the life functions either by virtue of their structure, or by virtue of some "spirit of life" within them. According to this view, then, two processes are necessary to fashion a living organism out of non-living matter: the first a process of organization, and the second either another process of organization or a process of animation by some external breath of life.

Anaxagoras did not concur with the prevalent view. His theory did not require two separate steps to produce life out of non-living matter. We have seen that Anaxagoras took full account of the observed fact that no substance is pure and of the further fact that in his day no substance could be verified experimentally to be elementary, in that his theory took all perceptible objects to be compounds containing particles of all other substances. Anaxagoras was therefore free to assume any substance to be elementary, and he chose as elementary all the different tissues of living organisms.[2] In his eyes, then, *life* was the underlying feature of the physical universe; and one of the inherent eternal properties of all matter, animate or inanimate, was the organic nature of its basic constituents.

The emergence of living organisms out of non-living matter thus needed but one act of organization, according to Anaxagoras. Since the basic particles were already organic, only a single operation was required in order for the life functions to become manifest. In the theory, when the elementary tissue-molecules are put together in the right way, the resulting object lives; otherwise the matter is inert, able to give rise to life, but not manifesting the characteristics of life as long as it remains in a state of disorganization.[3] For example, a kernel of grain can live and grow as long as its component parts are ordered properly. Once it is ground in a mill, however, its specific structure is destroyed, and its randomly strewn parts present the appearance of inanimate flour. *Life*, then, is inherent in all things, but the *life processes* can only come to view when the elements are suitably arranged.

Inorganic matter is a mixture of organic molecules which does not display the articulated structure characteristic of living organisms.[4] The only feature which distinguishes different kinds of inorganic matter is the definite proportion which holds between the various types of organic molecules contained in them. We do not know how Anaxagoras specified the exact proportions of all the different organic substances in, say, earth or water, or in any other inorganic substance; or whether any such precise specifications were made by him at all. Nor do we know whether he conceived inorganic substances to be composed of inorganic molecules, i.e. whether he conceived discrete, infinitesimal, inorganic molecules, every one compounded of a particular number of each of the elementary organic molecules, to be the building-blocks of inorganic matter; or whether he held that inorganic matter is simply a homogeneous mixture of organic molecules, i.e. a smooth, uniform blend of organic molecules combined in the proportion appropriate to the type of inorganic matter at hand. In fact these two pictures of the structure of inorganic matter would have been entirely equivalent for Anaxagoras. The first picture would correspond, for example, to the theory that earth is made of infinitesimal molecules of earth, each one a stable unit formed of a number of organic molecules combined in a certain proportion. In this case the organic components would first be bound into molecules, which would then form the substance in mass if an infinite number of them were brought together. The second picture would correspond to the theory that earth is made up of organic molecules mixed together uniformly in the right proportions to yield earth. In this case every piece of earth would have the same nature, because the mixture is uniform; even an infinitesimal piece of earth would be earth, because it contains the proportion of organic molecules that yields earth. In both pictures any amount of a given inorganic substance—even an infinitesimal amount—has exactly the same composition as the substance in mass. Since infinitesimal quantities of matter can never be observed, the difference between the two pictures is one of taste; it depends on whether you prefer to view inorganic matter as being composed of infinitesimal molecules which are tiny bound organic complexes, or whether you prefer to picture it as an amalgam in which no complex sub-unit has permanence. Hence, to postulate the existence of discrete, infinitesimal, inorganic molecules adds nothing new to the theory; still we cannot be sure that Anaxagoras did not speak of such entities, if only because it would have enabled him to picture every substance without exception, inorganic as well as organic, as being a separate molecular species.[5]

At any rate, the basic building blocks of *all* kinds of matter were conceived to be organic molecules of infinitesimal size. Since something infinitely small can never be observed directly, and since it was impossible to determine experimentally which kinds of substances are elementary, it becomes strikingly evident that theoretical considerations alone led Anaxagoras to choose one type of matter, the organic, to be elementary, and the rest to be compound. That this choice led to a simple, more economical explanation of the difference between the living and the non-living is testimony that Anaxagoras appreciated the fundamentally aesthetic principles of simplicity and economy in science.

According to Anaxagoras, the macroscopic bodies we see around us are formed through the conjunction of infinitesimal molecules. Any object of finite size, no matter how small, contains therefore an *infinite number of molecules*. In the case of organic substances, the majority of these molecules are molecules of the substance of which the object appears to be made. In the case of inorganic substances, the appearance of the object is determined by the proportion of different molecules within it. Homogeneously mixed into all objects however are infinitesimal pieces of every one of the infinite variety of substances which exist; so that even though an object appears to be made of one particular kind of matter, it contains within it all kinds of matter, and all kinds of matter can eventually emerge from it. Furthermore, since the pieces of foreign matter are uniformly mixed in with the predominating kinds of matter, any subdivision of the object has the same composition as any other subdivision and also contains something of everything.

Anaxagoras' picture of the composition of macroscopic bodies enabled him to account for the details of physical change. In Anaxagoras' theory, transformations can occur in a number of ways, all of which are processes of dissociation and recombination involving spatial rearrangement of the molecules. For example, some of the molecules of one of the substances which lies hidden from view within an object may be separated out of the object and be brought together elsewhere to form a new object, having the appearance of the substance extracted.[6] This occurs when a plant grows out of the earth—molecules of plant matter are extracted from the earth—or when salt precipitates out of a solution. The residual object which is left behind may still appear relatively unchanged (as do the earth and the solvent, in the examples cited above); or it may take on a different appearance if enough molecules have been extracted to alter significantly the composition of the body (as when digested food takes on the aspect of waste products after most of the nutritive tissue-molecules have been extracted for the body's use[7]). Another mechanism of change is the addition of a small or large number of molecules of some particular kind to an object. In this case the previously prevailing balance is upset, and the object takes on a new appearance determined by the new proportion of molecular components (as when wine is mixed with water). Alternatively, pieces of composite substances can dissociate, as Anaxagoras may have envisioned happening in cases of nutrition and growth (where he may have imagined that the decomposition of inorganic substances into their organic components also took place).

It now becomes clear why Anaxagoras was led to ascribe discrete absolute qualities to his elementary molecules, rather than endowing them with the full continuous range of observed qualities.[8] Suppose, for example, Anaxagoras had included in his theory particles having every degree of hotness. He would then have had to say that an object which is at room temperature contains in it a majority of particles having room temperature as their permanent, immutable degree of hotness. In order to explain how such an object becomes slightly cooler or warmer when placed before a window, or when moved a bit nearer to the fire, he would then have had to say that a considerable amount of matter is exchanged with the surroundings, such that most of the particles which are at room temperature leave the body, while other particles of the same substances as those that left, having slightly lower or higher temperature, enter the body from the adjacent surroundings in numbers large enough to form a new majority and so give the body its new temperature. Such great flows of matter obviously do not occur when slight, gradual qualitative changes take place. It is therefore clear that the qualitative continuum we observe can not correspond to a qualitative continuum in the elementary particles.

Anaxagoras however could give a much simpler explanation of qualitative change, since the infinitesimal size of the molecules in his theory enabled him to construct a continuum out of discrete quantities. By assuming, for example, that only two degrees of temperature exist, absolute cold and absolute hotness, and that one or the other was an immutable property of every molecule, Anaxagoras could account for an object having any intermediate temperature lying in the continuum between the two absolute endpoints by assuming that the object contained an appropriate ratio of molecules of each of the two extreme temperatures.[9] The fact that the molecules were infinitesimal in size made it possible for the qualitative continuum to be completely smooth, with no gaps or jumps. Furthermore, transitions which take place from one state to another differing only a little from the original one could now be accounted for in a reasonable manner: a *small* transfer of matter to or from an object would suffice to alter the ratio of molecules having the two qualitative extremes, and so to alter the value of the observed quality to a neighboring value. The number of molecules transferred in any process of qualitative change would thus be proportional to the extent of the change. In particular, small or gradual changes could occur with no perceptible transfer of matter to and from the surroundings—in complete agreement with observation!

In Anaxagoras' theory, then, each of the basic molecules possessed a set of basic, discrete, absolute qualities. Each one of these qualities represented one of the contrasting extremes bounding the continuum which that quality is observed to span.

There are a number of consequences from this theory of matter which appear at first sight to be paradoxical. In the first place, since Anaxagoras considered only the extremes of the qualitative continuum to exist in the real sense of the word, no predicate could truly be applied to any actual object in the world; the statement that a specific property really belonged to any given object could never be valid.[10] This is because any actual thing, according to Anaxagoras, contains within it, as part of the mixture which makes it up, at least *some* matter which has each of the contrasting extreme qualities, and a property which manifested itself at any particular moment could disappear from view as the result of ever so slight a mechanical displacement of some of the body's component parts. The only predicates in the theory that could ever be imagined to be valid of a body are the contrasting extremes, since only these really exist in the theory. But since every body contains some of each of the extremes, neither one of the extremes could be legitimately predicated of the body as a whole; nor could *both* extremes be predicated of the body, since in that case contrasting predicates would apply to the same body simultaneously, in obvious violation of the Law of Contradiction.

The only exception might be thought to occur in the case of a pure body made up either entirely of one kind of substance, or of substances having only one of the two absolute extreme qualities. Here however we come face to face with a second interesting consequence of Anaxagoras' theory, that *no perceptible substance or quality is or can ever be pure.* That none *is* pure we have already seen, since every object in the world—as Anaxagoras saw it—actually contains something of everything. That none *can ever be* pure is guaranteed by the infinitesimal size of the molecules, because any process of purification involves the transfer of finite pieces of matter (though they may be very small), and these always contain at least *some* infinitesimal molecules of everything else.

A third consequence of the theory is that all objects of finite size contain the same number of molecules, an infinite number. Thus, though there is more water in a pail than in a thimble, or, to take another example in a somewhat different vein, more water than flesh in a pail of water, there are the same number of molecules present in both. This, of course, is just another of the long list of paradoxes of the infinite which led natural philosophers soon after Anaxagoras to abandon for all practical purposes all infinite quantities, whether infinitely large or infinitely small, at least in so far as their specific theories were concerned. Even Anaxagoras did not suggest that the range of variation of any of the observed qualities is infinitely extended. Even he assigned definite limits to this range, postulating the existence of extremes of qualities defined by the pairs of contrasting absolute qualities. Perhaps even he was not prepared to admit into his theory infinite quantities where he did not feel they were required by observation and logical analysis.

Chapter Four

THE FOUNDATIONS OF DYNAMICS

Anaxagoras was the first to realize that it is not enough to determine the nature of the material components that make up the universe, but that it is necessary also to provide an explanation for the motion and change that matter undergoes.[1] He did not content himself with saying that matter behaves the way it does because it is its nature to behave that way, but he sought a single unifying principle from which could be derived in all its detail the behavior of each and every part of the universe for all time.[2]

The desire to find a single, all-embracing, dynamical principle was bequeathed by Anaxagoras to all physicists who came after him. What was involved was the rejection in principle of a system of theoretical physics based on a multiplicity of laws, each governing particular kinds of matter, or particular types of event, or particular eras of time. Anaxagoras clearly indicated that the goal of dynamics is the discovery of *one* law, *one* force, which governs all the many phenomena of physical reality.

Anaxagoras was looking for something which has the following characteristics: (1) It must be one, not many. (2) It must be responsible for all motion and change of state that takes place in the world and must suffice to explain and give direction to all physical change. (3) It must be thoroughly logical and rational, and devoid of any mythological, capricious, or even theological character.[3] (4) It must account for the marvelous order visible in the universe and for the harmonious functioning of all parts of the physical world. Postulating that such an entity really exists, Anaxagoras gave it a symbolic name, the name ordinarily given to the single agent which fulfills all these functions in living beings—"Reason" or "Mind."[4]

In applying this name to a cosmic entity Anaxagoras was making use of a method frequently resorted to by scientists, and fundamental in human thought: the method of analogy. By analogy, one isolated phenomenon can be connected to and explained through another with which it has features in common; in this way Anaxagoras accounted for plant behavior in terms of animal behavior,[5] for lightning flashes in terms of ordinary fire,[6] and for the sun in terms of glowing red-hot ore.[7]

By analogy too a universal phenomenon can be related to and rendered comprehensible through a particular one; in this way Anaxagoras accounted for the creation of the world in terms of rotational fluid motion,[8] and for its continued functioning in terms of the factor which maintains the functioning of living things.[9] By such analogy Anaxagoras introduced into his system the conception of a cosmic mind as that which accounts for the ordered, rational behavior of physical reality, and he pictured the behavior both of the individual and of the universe as manifesting the presence of the same dynamical agent, Mind.

The mind of man is generally credited with displaying many of the characteristics of Anaxagoras' cosmic Mind. Mind in man seems to be characterized by rational thought. It enables man to control his environment and to impose some order on the things around him. The mind allows man to initiate processes of motion and change, and endows him with the capacity to govern much of what is around him. Anaxagoras also identified with the mind of living organisms all their manifestations of structure, even those which we today do not normally associate with the mind.[10] Thus, for example, the physiological function of digestion by which food is ingested and from it are extracted those substances which make up the tissues of the body was for Anaxagoras a function of the mind. Similarly, the reflex actions and instincts of plants and animals, as well as their ability to grow and thrive on nourishment provided by the surroundings, indicated to Anaxagoras that they too possess minds.[11]

The analogy between the mind of individuals and the cosmic Mind was more than a casual analogy for Anaxagoras. In his eyes the highly specific structure and behavior of individual plants and animals indicated that each of them is permeated by its own individual mind, which allows it to move, and to change, and to control its surroundings.[12] In just the same way, the order and structure of the universe as a whole indicated to him the omnipresence of a cosmic Mind which can move and control its sphere of influence—the entire universe—in a rational way. The cosmic Mind pervades all of nature just as the mind of each individual living being pervades its entire body.[13]

The hypothesis of a cosmic Mind was the perfect complement to Anaxagoras' theory of the composition of matter. For we have seen above that at the heart of his theory of the nature of matter lay *life*, which was basically linked to all material things. Here, we find at the basis of his theory of motion and change the dynamic, rational, and ordered aspect of life, namely, Mind. Thus the entire universe took on the aspect of an infinitely great, perfectly structured organism, constructed out of the same basic matter as living organisms, and governed by the ruling power of Mind.[14]

Mind embodies the idea of natural law. It does not possess caprice or will or the ability to make decisions. Instead, it was meant to be the source of all changes in the universe, as well as the source of all static order. Anaxagoras' theory of a cosmic Mind was the expression of the conviction that all of nature behaves according to strict law; that there is no such thing as disorganized behavior; that nature knows no chaos or randomness; that, in short, law and order characterize all the matter in the universe wherever it is found. Thus, according to Anaxagoras, Mind is in all things and controls all things, since everything is ruled by reason.[15]

Mind was real for Anaxagoras, as real as the order and change for which it was responsible.[16] In fact, Anaxagoras' assumption that Mind exists as a real entity summed up his belief that the order and change we perceive around us are not illusory, but are actual elements of reality. The law governing the motion of matter was for Anaxagoras an unchanging, eternal law, because Mind, which embodied this law, was real and hence immutable, and completely free from change or alteration. In essence then two basically different kinds of things truly existed as far as Anaxagoras was concerned: infinitely varied matter with its characteristic properties; and Mind, the single dynamical agent responsible for everything that happens.[17]

One would naturally expect that a theory which includes a single comprehensive factor to account for the behavior of all things in the universe would also show *how* the workings of Mind are manifested in detail. In introducing Mind Anaxagoras was declaring his belief that there does not exist more than one basic explanation for physical phenomena, thus leading people to hope for an explicit formulation of the basic principle or law governing all of nature, or at least for a general description of the law governing the behavior of Mind, from which all phenomena could be deduced as particular cases.[18] Unfortunately Anaxagoras did not provide such a unified law, and his successors took him sorely to task for this major flaw in his theory (though they in turn were hardly more successful than anyone has been in their search for such a law).[19] In his discussion of specific phenomena Anaxagoras resorted to purely mechanistic explanations based on a variety of mechanical and biological laws of the kind used by other natural philosophers of his day.

It is difficult to suppress a feeling of disappointment in a theory which announces that a unified principle exists and then fails to set it forth. Nevertheless Anaxagoras deserved the praise lavished on him in his own time and ever after for being the first to look for such a unifying principle and to make its existence a cornerstone of his theory.[20]

Chapter Five

MIND AND THE THEORY OF PERCEPTION

For Anaxagoras, Mind was very real. Its effects could be seen in living beings as well as in the universe, and every process of physical change could be ascribed to its presence. What kind of thing was this Mind?

In living organisms the mind can not be seen. It is not an organ nor a particular kind of tissue; but as the factor responsible for all the life functions it makes itself felt throughout the entire body, and it exerts its influence on all the organs and tissues. The mind can not be felt, nor does it have any perceptible weight. Indeed it can not be detected at all through the senses. By analogy Anaxagoras concluded that cosmic Mind too could not be composed of any of the substances which we know through the senses, but that its substance is imperceptible. Because it could not be perceived, like the basic building blocks of matter, its existence and characteristics too could be deduced from observable effects only by means of theoretical arguments.

For Anaxagoras all the perceptible objects in the world are regulated in every detail by Mind. In order to exert total control Mind must perceive, recognize, and constantly observe and survey all the matter, all the molecules that exist.[1] Hence Mind must possess the faculty of perception and be able to interact with matter in order to govern its behavior.

Anaxagoras' analogy between cosmic Mind and the mind of an individual living being was thoroughgoing. The mind of an individual is not perceptible; it interacts with the matter of which the body is composed, governing the motion of the organs, and perceiving and knowing the information registered by the different parts of the body; and, according to Anaxagoras, who extended the range of activities governed by the mind considerably beyond the range generally attributed to it, the conscious mind regulates and controls all the activities and changes in which all parts of the body participate. So too, by analogy with the individual functioning organism, the cosmic Mind in the universe is imperceptible; it interacts with the matter of which the world is made up, governing the motion of all objects, and perceiving and knowing all the physical changes occurring in different parts of the world; and it regulates and controls all the activities and

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changes in which all things take part. The fundamental question that Anaxagoras had to answer in the case of cosmic Mind was the same question that must be answered by all those who attempt to explain the workings of the individual mind: How can something perceive, when it itself is not perceptible? How can something interact with matter and control it, when it itself has none of the characteristics of material things?

Anaxagoras turned to the study of how the mind perceives in living organisms, in order to learn by analogy the way cosmic Mind perceives. And in order to understand how the mind in living organisms perceives material things, he studied first the mechanisms by which sensory organs, themselves material, register the stimuli they receive from other material objects in the external world around them. We are therefore obliged to digress in order to consider Anaxagoras' theory of sensory perception in animals.[2]

According to Anaxagoras, perception is a physical interaction between the sense organ and the object sensed, an interaction between the matter that makes up the sense organ and the matter that makes up the object perceived. The interaction gives rise to an irritation or slight prickling sensation in the living organism. The interaction that takes place is thus one in which the object sensed affects, or changes the state of, the sense organ. Starting with this realization, Anaxagoras set about to study the conditions under which one body can cause a physical change in another.

Anaxagoras took as his starting point the generally observed fact that two bodies having exactly the same properties in all respects do not affect one another when they are brought into contact. For example, when two liquids having the same taste, color, density, etc. are mixed, the resulting liquid is no different from either of them in its properties and composition; when two bodies having the same temperature are in thermal contact, no temperature change occurs in either body, nor do any of the physical properties dependent on temperature undergo change; in a similar manner two notes of the same pitch sounded simultaneously can not be distinguished from each other. Only if the bodies which are involved in an interaction are *different* in at least some of their properties will a noticeable change occur: thermal effects will be observed when a warmer body is brought into contact with a cooler one; a fluid mixture will be different from its components when the components themselves are somehow different from each other; sounds will be distinguishable when they are of different pitch. Anaxagoras summarized the results of these common everyday observations in a general law of physics, that *interactions* *which lead to observable physical change can take place only between bodies whose states differ in some way.*

Anaxagoras went on to apply this principle to the interactions which he thought constitute perception. We know that Anaxagoras wrote in some detail about the mechanism by which each of the senses functions. Unfortunately there survives only a fragmentary description of this part of Anaxagoras' work, so that we are able to reconstruct only a small fraction of his theory of sensory perception.

Anaxagoras' statement that everything contains within it some molecules of everything else applied of course to the sense organs as well. They too contain all kinds of matter possessing all of the qualities that exist. Thus some properties of the sense organs are usually different from those of any particular object sensed. This difference makes perception possible, since the interaction which gives rise to sensation occurs whenever properties of the perceived object are different from properties of the sense organ with which the object comes into contact. In this way, for example, we become aware of heat when an object in which hot molecules predominate comes into contact with our organ of touch, provided only that the *exact* same proportion of hot to cold particles is not present in both the object and the sense organ (a relatively unlikely coincidence, given the endless variety of proportions and temperatures which can exist). Similarly, hard objects are felt if the organ of touch yields to them, and soft bodies will be perceived if the organ of touch is harder than they. Anaxagoras was able to explain the functioning of the organs of touch generally, along these simple lines.

We do not know how Anaxagoras explained the mechanism of the sense of smell, beyond the simple fact that he noted that we smell when we inhale. In regard to the sense of hearing Anaxagoras held that sound is a disturbance transmitted by air, which is heard when it is carried into the sinuses of the head and reverberates there. However, the exact mechanism Anaxagoras postulated for the perception of sound is lost to us.

Of Anaxagoras' account of the sense of taste little more remains than what we know of the sense of touch. The organs of taste perceive a certain taste as a result of the interaction between matter taken into the mouth and matter of a different flavor residing in the mouth. Thus when something sweet is eaten it is perceived by the particles of bitter matter in the taste organs of the mouth, and when something salty is taken in it is perceived by particles of bland matter. (We have no reason to believe that different tastes were thought by Anaxagoras to be localized in different parts of the mouth. His was not, as far as we know, a rudimentary theory of taste buds.) Again the presence of all qualities in the matter which makes up the organs of the mouth enables us to perceive all the different kinds of tastes.

A fairly complete account of Anaxagoras' ingenious theory of vision has survived. Anaxagoras noticed, by means of what must have been very careful observation, that we see exactly those images which are reflected in the pupil of the eye—no less and no more. Today we have no difficulty in understanding this, because we know that light stimuli are registered on the retina in the interior of the eye. Since the retina can only record light that enters the eye, and since the only opening into the eye is the transparent pupil, it is clear that we see only that light which passes through the pupil. Since we also know that when light passes through a transparent object some proportion of the light is always reflected, it comes as no surprise to us that precisely those images which appear on the retina are reflected in the pupil, through which their light passes on the way to the retina. For Anaxagoras, who did not know the role the interior of the eye plays in vision, and ascribed the primary role to the surface of the eye—where the eye and the outside world come into direct contact—it was no small feat to discover that only the image reflected in the pupil, and not any part of the image reflected in the iris or in the white of the eye, is actually seen. From this remarkably precise observation Anaxagoras concluded that only the pupil plays a role in vision, and that the mechanism of visual perception is *the reflection of light in the pupil.*

The pupil of the eye is black. Therefore, according to Anaxagoras' general theory of interactions, all objects which are *not* black will be reflected in the pupil and consequently be seen. In fact black objects can never be seen at all unless they are illuminated by some external source of light. Furthermore, the brighter the objects the sharper the contrast with the pupil, and hence the more distinctly they are seen. This explains why objects hidden in shadows or obscured by hazes are seen less clearly than objects bathed in sunlight or otherwise adequately illuminated. For the same reason the ability to discern objects decreases as night approaches, and it disappears altogether in total darkness: the black of night is the same color as the black of the pupil, so that there is no difference at all between the color of the organ of sight and the color of the surroundings, and no interaction can take place. Another apparent point of support for Anaxagoras' theory is the observation that many animals noted for their keen nocturnal vision have bright eyes.

In general for all the sense organs, the larger the animal, the larger the organ. This means that the region over which the sensory interaction takes place is proportional in size to the size of the animal. In this connection we have a cryptic statement of Anaxagoras' to the effect that large animals perceive more than do small animals. We do not know whether this statement means that large animals can perceive larger objects, that is, that they gather stimuli from a broader field of perception; or that they can perceive objects which lie at a greater distance, that is, that the depth of their field of perception is greater; or that they can perceive finer details, that is, that their perception is more sensitive; or whether it means all or some or none of these things.

All the mechanisms of sensation discussed above are specific instances of the general law governing the way in which perception occurs: in all cases of perception, in all the processes which lead to the acquirement of knowledge, the mechanism of sensation must be an interaction between things having different properties. This then is the universal principle that is suggested by a study of sense perception in living beings. It is this that Anaxagoras used to describe the nature of Mind.[3]

By definition, cosmic Mind perceives and has knowledge of everything in the universe. Nothing is hidden from it; all processes are controlled by it, and it must comprehend them all. Its activity pervades everything, since everything in the universe is governed by natural law. Now according to Anaxagoras' theory of perception these properties of Mind could lead to only one conclusion about the nature of Mind: Mind must be different from *everything* in the perceptible universe; in particular, Mind must be different from *all* matter.[4] Nor can Mind have any of matter's properties; it can not have weight, hardness, moisture, elasticity, color, temperature, or *any* of the qualities which apply to matter. For if Mind was like any substance or had any of these material qualities, it would be unable to perceive, know, and comprehend that substance or quality which it resembled. Mind therefore, which pervades all the matter in the universe, is entirely free from the admixture of any of the matter in the universe. Mind is, in short, the opposite of matter: it is incorporeal.[5]

Because of the confusion that can easily arise in this matter, it is worth noting explicitly that there are two basic kinds of incorporeality. There is the incorporeality of color, temperature, number, shape, extension, character, and all such *predicates*. These things are incorporeal by definition, since they are by definition *attributes* of objects and are on a different conceptual level and in a different logical category from matter. This however is *not* the incorporeality of Mind, because Mind is not an attribute or property of matter. Rather, Mind is something which acts on and affects matter, and which is itself qualified by predicates. Mind's incorporeality is of the second kind: the incorporeality of real substantial entities whose presence is felt by matter and whose force is manifest in matter; the incorporeality of things which are themselves qualified by a variety of properties, but which can not be directly perceived, and have none of the properties commonly associated with perceptible matter. This second kind of incorporeality is the kind commonly associated with the soul. It is the incorporeality usually intended by the theologian when he speaks of an incorporeal God. It is the incorporeality associated with the forces used by physicists in their description of dynamical laws. It is the incorporeality which has always been attacked by those who would consistently eliminate from their formulations all entities which are not directly perceptible. This is the incorporeality of Mind, which involved the conception of some kind of real, effective, pervading thing which is totally different from anything material.

Anaxagoras was the first Greek thinker to introduce into his system of thought an incorporeal substantial entity. He was the first to conceive the possibility of the existence of such an incorporeal substance, and his conception had a profound influence on succeeding generations of scientists and philosophers even to the present day.

Chapter Six

THE CREATION OF THE WORLD

The general features of Anaxagoras' cosmogony were again drawn by analogy from everyday experience. Whenever a structured object is formed, whether by artificial or natural means, the process involves the arrangement of disorganized pieces of matter into an ordered whole. At first there is no sign of the emerging entity in the disordered parts, and none of its distinctive features can be seen in them. Then, at some time which marks the beginning of the object's appearance, some slight gross order comes to view; then more and more structure appears, until finally the end-product stands before us, complete in all its details. Anaxagoras drew an analogy between innumerable particular instances of this type, and cosmic occurrences which involve the entire universe and all that is in it, and constructed his theory of the creation of the world by generalizing from specific cases to the cosmic event in which the world came to be.[1]

According to Anaxagoras, all the matter in the universe originally lay in a jumbled heap for endless aeons of time, completely unformed, motionless, and unchanging. A mass of infinitesimal particles indiscriminately mixed together, containing all the varieties of matter which we see around us (which always have existed and always will exist), lay dormant and static, undergoing no process, showing no order, and revealing no design. For an infinite eternity, from the beginning of time, the infinite universe was motionless. No single kind of matter predominated in, or bestowed its particular characteristics on, the mixture; the mixture was completely disordered and all the various kinds of matter with all their qualities were strewn about in it in random chaos. Thus the universal mixture had no distinguishing property or special aspect, since no single one of the components it contained was able to come to view.[2]

Not only were all parts of the mixture stationary relative to each other, but the mixture as a whole did not undergo translational motion either. This is because the mixture was infinitely large, there being always more beyond any point, and there was no place beyond it into which it could have moved.[3]

Mind, the source of all motion, change, and order, was inactive during this entire span of time. It had not yet begun its work. In this period the dynamic laws of nature had not yet taken hold of the physical universe; this period of dormancy knew no change of state. We do not know how, or whether, Anaxagoras got himself out of the impossible position he had taken in this regard: for by carrying out his generalization from particulars to the universe, he had ended with the paradox that Mind, and hence the law that governs change, being real and eternal, always existed, but its effects were nowhere felt during the infinite span of time before the creation.[4]

At a certain moment however, according to Anaxagoras, Mind began to function, and by instituting motion began to impose order on the chaotic matter which filled the universe. Anaxagoras described in terms of familiar natural laws the series of mechanical processes by which Mind effected this fashioning of the world. These was nothing supernatural about these processes; they were the same as those going on in the world today.

The first stage of the creation comprised the massive rearrangement of matter necessary to give rise to the gross structure of the universe as Anaxagoras saw it. The first step was to separate heavier from lighter matter, leaving a core of earthy and liquid substances surrounded by air and other gases and vapors. What common physical process could cause a random mixture of different kinds of matter to be separated into a central core of higher density and a surrounding medium of lower density?

Anaxagoras found the answer in the observation that eddying liquids or gases draw to their center objects denser than the medium. Ships are sucked into the heart of great whirlpools at sea; dust is pulled to the center of vortices in windstorms; houses and trees are drawn into the eye of cyclones. Whenever a fluid is set into rotation a rearrangement of the matter within it takes place, and denser objects are drawn towards the center of the whirl.

Anaxagoras identified the natural physical process through which Mind acted and effected the first stage of the creation with the separation of heavier from lighter objects caused by whirling motion.[5] According to him, Mind began its work by churning the universal mixture, and so brought most of the dense matter in the universe to the center, and left air and other lighter material predominating outside. This was only a coarse separation; there remained molecules of heavy matter all throughout the outer regions of the universe and molecules of light matter all throughout the earth, because there are some molecules of all kinds in all things. So the universe took on for Anaxagoras the aspect it seems to have at first sight: a concentration of dense substances around the center of the earth and a distribution of light substances around the earth and out to infinity; and Anaxagoras believed that the process which caused the originally homogeneous mixture to take on this aspect was the churning motion initiated by Mind as the first step in the creation.

When the gross structure of the universe had been established, the churning motion died out. The matter in the universe reached a state of over-all stability, and large masses of different substances were no longer continually churned about. It is not clear whether or not Anaxagoras tried to explain the rotation of the heavenly bodies as the one remaining vestige of the original churning motion. At any rate the heavenly bodies are the only large bodies which still participate in rotational motion on a cosmic scale, while in Anaxagoras' view the original churning, which had once involved all the matter in the universe, had long since ceased.[6]

We know that Anaxagoras dealt somewhere in his theory, probably in the description of the cosmogony, with certain angles of inclination.[7] What these were we have no way of ascertaining. They may well have been related to the angle of inclination of the celestial equator to the surface of the earth, or to the angle of inclination of the plane of the ecliptic to the surface of the earth.

The workings of Mind were also responsible for every detail of the present order of things. For according to Anaxagoras the formation of each of the particular distinct objects in the world, and the organization of every specific sub-system in the universe, were all directly traceable to the action of Mind as manifested in some natural process.[8] Through appropriate and usually different mechanisms in each instance, Mind brought about the formation of the sum total of all things in the universe and set everything in order. We do not know how Mind succeeded in producing the fine structure of the universe; but however Mind completed its work of creation, when it was done, the universe as we know it stood entire. The flat earth lay at rest at the center, its large flat expanse supported by the mass of air beneath it, much as a large flat kite is supported as it floats gently in the air.[9] On the earth geological formations were created, vegetation arose, animals came to be, and finally civilizations emerged, until at last the earth acquired all its present features. The creation was over. Mind, which had brought it about, had now only to keep it going according to natural law.

Chapter Seven

SPECIFIC PHYSICAL THEORIES

In the following chapters we shall present the few surviving remnants of Anaxagoras' specific theories, which were meant to serve as scientific explanations for the detailed behavior of material objects in the world around us.

One of the first things the student of physics is called upon to explain is how things move in general and how free bodies behave in particular. It is readily seen that in the absence of any obvious external force of constraint, there are two kinds of motion which normally occur in everyday life: rectilinear motion in the up-down direction and rotational motion. In both cases the way bodies move depends on their density, so that objects of higher and lower densities can be distinguished from one another by their behavior; in the up-down motion occurring in nature, bodies released at rest and permitted to move freely tend either towards the earth if they are denser than air or away from the earth if they are lighter than air. In circular motion of the kind observed in whirlpools heavy bodies are distinguished from light ones by the fact that they move towards the center while the lighter ones move to the periphery.[1]

We have seen in the previous chapter how Anaxagoras made use of the behavior of fluid vortices to construct theories which pertained to the universe as a whole. In the case of vertical linear motion too it was a simple step for Anaxagoras to generalize from everyday observations to the law that *all* heavy bodies, heavier than air, not subject to constraint will fall downward. An immediate consequence of this law, one which has plagued people from earliest times, is that the entire earth should be falling through space! Since it obviously does not fall, but remains instead quite motionless—as anyone can see—Anaxagoras had to seek some physical mechanism which would allow a body that would normally fall to remain suspended. Once again he was able to call on experiences familiar to all; everyone has seen leaves, pieces of paper, and birds with outspread wings hovering in mid-air, supported by the resistance of the air beneath them. Furthermore, it is well known that the larger the surface area of a body the greater the ease with which it remains aloft without falling. The great force which so insubstantial a thing as air can muster against a heavy object can easily be seen on windy days, when air alone is able to impel ships and even to destroy trees and buildings. Anaxagoras reasoned that the earth, being flat and immense in size, could with little difficulty be supported by the air beneath it. He pictured the earth as a great flat expanse floating motionless on a cushion of air.[2]

The tendency of light objects to rise and heavy ones to fall indicated to Anaxagoras the presence of a fundamental up-down asymmetry in the universe at the present time.[3] On the other hand in recounting the creation of the world, he had invoked a different dynamical process involving circular motion, which served to collect heavy matter at the center where the earth was formed and to disperse light matter all around to the farthest reaches of the universe. Indeed Anaxagoras could not have used the natural rectilinear motion of heavy and light matter in his cosmogony, since such motion simply separates heavy from light in an up-down direction. Had he made use of vertical rather than circular motion, he would have arrived at a theory in which all the heavy matter in the universe fell downward, and all the light matter rose upward; so that there would have been no way for dense matter to come together to form a cohesive solid mass of earth, since all dense matter would be falling and there would be nothing tending to bring it together. Anaxagoras was forced therefore to introduce a churning motion during the creation of the world.

However, as we have seen above, as soon as the creation was complete, the general rotational motion died out. In place of it there then appeared the vertical linear motion which has since been the natural motion of free bodies when released from constraint. Still, some vestiges of the spherical symmetry which held sway during the creation remained even after up-down asymmetry had been introduced—a feature which caused no little embarrassment to Anaxagoras' theory in its final form. Thus, the original churning motion brought heavy substances to the center of the infinite universe and caused these to be surrounded on all sides by lighter gaseous matter, even at the present time, though this state of affairs is not at all consonant with the vertical asymmetry which causes light matter to rise and heavy matter to sink to the very bottom of the universe! The inherent contradiction between these two pictures, the result of the very different dynamical properties of free fall and of rotational motion, does not seem to have occurred to Anaxagoras. He apparently saw no problem in stating at one and the same time that gases always tend to rise above solid matter and that there is air all around the earth, even underneath it.

Since Anaxagoras considered the air beneath the earth capable of supporting the earth, he was clearly aware that a gas has the ability to exert considerable pressure even when it is at rest and not only when it is moving in violent gusts. Anaxagoras was one of the first to demonstrate experimentally that air, which seems so insubstantial—the same air which is so easily riven and which usually scarcely impedes a body moving through it—can in fact resist a large impressed force. Anaxagoras showed this to be true in public demonstrations, of which reliable reports have survived.[4] In one experiment he inflated a wine skin and then twisted the neck of the skin until the compressed air rendered its pliable container firm and hard. He then showed that under these conditions the skin would resist a considerable force exerted against it, due to the counter-force exerted by the air trapped inside. Two other experiments were performed with the aid of a water clock, or clepsydra, a simple instrument designed to measure time. The water clock was a container with small holes in the bottom and with an opening at the top fitted with a stopper. The device was operated by filling the container to a prescribed level while the holes in the bottom were covered. As long as the top was stoppered the water would not escape through the holes in the bottom, provided the clock was held in a vertical position. When the stopper was removed the water streamed out, and intervals of time could then be measured in terms of the volume of water that had flowed out. By adjusting the size and number of the holes or the size of the container, clocks could be manufactured which conveniently measured any desired length of time. These clocks were commonly used, for example, in courtrooms to time speakers; they were well known devices from ancient times on.[5]

The two demonstrations Anaxagoras performed with such water clocks were the following. In the first he took an empty water clock and stoppered its open end. After doing this, he plunged it vertically into water and showed that no water entered the holes at the bottom. He correctly interpreted this result to mean that the air inside the water clock, because it was trapped in a closed container, exerted sufficient pressure to keep the water from entering. In the second experiment he investigated the behavior of a filled water clock. First he showed a filled water clock closed with a stopper, with no water flowing from it. Here, he explained the fact that no water flowed out as being due again to the force of air, this time of the air pressing up against the water through the holes in the bottom of the water clock. Then he removed the stopper and allowed the water to flow. Since the only difference between the two situations was the absence of the stopper in the second case, Anaxagoras concluded that the water could leave the container because air was able to flow around from the bottom to the top to make room for the escaping water. With such experiments, Anaxagoras attempted to convince his audience that the air around them was indeed capable of exerting pressure.

Anaxagoras did not ascribe any of the effects observed in these experiments—or anywhere else, as far as we know—to *atmospheric* pressure. He certainly did not envision the blanket of air around the earth as having any weight, for air was nowhere observed to fall downward, or to crush anything under its weight. What Anaxagoras meant by the force exerted by air was an elastic resistance of air, the kind of resistance offered by virtually every material medium subjected to compression. This elastic resistance is, to be sure, the source of the resistance he saw exerted by *trapped* air in the course of his demonstrations. Anaxagoras however believed the same resistance on the part of free air to be responsible for keeping water inside a stoppered clepsydra, though unenclosed air has nowhere near enough resistance to justify such an assumption. In fact, such a high degree of elastic resistance for air not enclosed in a container would be entirely incompatible with the observation that bodies pass through air for the most part with great ease.

Anaxagoras also used air's resistance to compression to explain why leaves and other light flat objects float in air, and here his explanation was correct. This is the property of air which enabled him to make plausible his theory that the earth floats on the air beneath it like a huge leaf. From the experiment he performed with a filled water clock Anaxagoras thought he could conclude that the only way the earth could sink to a lower position would be for some air to creep out and around from under the earth, as it flows around leaves, allowing them to sink slowly downward. However, if the earth is sufficiently large such a process can not take place, since it requires large subterranean currents of air for which there is no evidence at all. The great size and flat shape of the earth, together with the elastic properties of air, therefore assure the earth its stability.[6] Once again we see before us an example of how Anaxagoras extrapolated the observed properties of terrestrial systems to cosmic dimensions.

The fact that Anaxagoras illustrated his scientific lectures with demonstrations is in itself significant. It shows that in Anaxagoras' day it was not unusual to supplement direct observation with active experimentation and that the experimental branch of natural philosophy, which was gradually to match and outstrip the purely observational branch, was already an acknowledged partner of the theoretical branch as far back as the time when rigorous scientific method was being born.

By combining theory and observation Anaxagoras concluded also that there is no such thing as a void, i.e. no such thing as absolute emptiness.[7] Logically this followed from the Law of Contradiction; for it is impossible for something which does not exist in any way, and which has none of the characteristic properties of existing things, to exist. Observationally it was based on the fact that all of space around us *is* filled with something. In addition, Anaxagoras' experiments with wineskins and clepsydras served also to demonstrate that even what appeared to be totally empty space was actually filled with air, which turns out to be a very substantial thing indeed. Moreover, suction phenomena provided additional proof that some matter always rushes in to fill a space which is in the process of being evacuated. Here too Anaxagoras generalized his experience into a fundamental law of nature, which stated that the whole universe is a material continuum filled everywhere with the same kinds of matter and containing no gaps of absolute emptiness.

It was easy for him to explain how objects are able to move from place to place even though all of space is filled with matter.[8] For liquids, which certainly appear to be continua, obviously allow of motion, whether it be the motion of one part of the liquid sliding over another or the motion of a solid object cutting through successive parts of the liquid. So too all matter manages to move by displacing the surrounding medium; and the motion proceeds with more or less difficulty, depending on the resistance offered by the medium.

Anaxagoras took as a basic law of physics the familiar observation that, in fluids, warm matter tends to rise and cold matter to descend, thus making use of the notion of heat convection which is one of the most important means of explaining the transfer of heat from one place to another.[9] Anaxagoras realized that the mechanism of heat convection is operative on a large scale as well as in specific small-scale instances of heat transfer, taking it to be one of the main factors responsible for meteorological phenomena.[10]

Anaxagoras seems to have understood what it is that causes convection currents to flow. He was aware that a hot substance is less dense than a cold one.[11] Knowing this, he had only to invoke the gravitational properties of matter in order to account for the fact that hot matter, being less dense, rises above cold matter, which in turn descends to take its place. Though we have no evidence that Anaxagoras actually took this step in his thinking, it is not unlikely that he understood the reason for heat convection.

Anaxagoras did speak of a coarse separation of different kinds of matter according to density during the creation of the world, as a result of which the lightest—and hence, for the most part, predominantly hot—substances occupied the region of space farthest removed from the earth. What actually occurs in nature is that the temperature of the air gets *lower* as one proceeds to higher and higher altitudes but according to Anaxagoras this was only a local fluctuation in the over-all picture, because he held that as one goes even farther from the earth into the regions of outer space the temperature rises to that of flaming-hot aether.[12] In order to impress his readers with this "fact," Anaxagoras gave an etymological explanation, which would be in accord with his picture, for the name "*aithēr*" ("aether") by which the outermost reaches of the universe were popularly known in his day. He pointed out that this commonly used name could easily and appropriately be derived from the verb *aithō*, which means "to be burning hot."[13]

Anaxagoras also dealt with certain aspects of optics. More than any other early physicist he is associated with the conviction that light travels in absolutely straight lines, believing in the completely rectilinear propagation of light even over cosmic distances.[14] His theory concerning the reflectivity of different surfaces, an offshoot of his general theory of interactions, stated that the ability of a given mirror to reflect light depends on the contrast between the color of the incident light and the color of the reflecting surface, and that the greater the contrast between these two colors the more strongly and clearly will the incident light be reflected; whereas incident light of a color which is the same as the color of the mirror on which it falls will hardly be reflected at all.[15] His color theory, to which his theory of reflectivity was related, requires further comment.

Anaxagoras seems to have shared with most physicists of his time, as well as those of succeeding generations up to modern times, the theory that all colors lie on a continuum between two extremes represented by black and white.[16] It is well known that all colors merge into blackness as they become darker in shade and that they approach closer and closer to whiteness as they become lighter in shade; so that in fact all colors become more and more similar to each other as their shades get nearer and nearer the two extremes. This was taken to indicate that each hue lies on a one-dimensional continuum between black and white; and a graphic representation of this color theory would show each color lying on a different curve joining the same two endpoints of black and white. Anaxagoras could consider black and white as the two basic primary colors, since in a sense all other colors lie between these extremes—just as in the case of temperature he took absolute hotness and absolute cold to be the two primary degrees of heat. The only difference between color and other qualities is that in the case of color there are many different paths between the two extremes, corresponding to the various hues. This means that a certain proportion of black and white molecules does not uniquely define a *hue*, though it does define a *shade*. How Anaxagoras accounted for different hues, whether by assuming different *kinds* of black and white extremes for each hue, or by some other method, has not come down to us.

As applied to Anaxagoras' theory of reflectivity, his theory of color implied two things. First it implied that a mirror of a given *hue* will reflect light of a hue different from the mirror's, which is therefore able to interact somehow with the mirror's surface, better than it will reflect a hue close to its own. For example, a mirror of polished red bronze will reflect a red bronze object more poorly than any other kind, in the sense that the image of the red bronze object will be harder to make out. Second, Anaxagoras' theory of reflectivity implied that a mirror of a given *shade* will reflect other shades (of all hues) more strongly and clearly than it will reflect a shade like its own. For example, a mirror whose surface is light in color will reflect dark shades of all hues better than it will reflect light shades of these hues.

There remains only a tantalizing remnant of a theory concerning the nature of sound and thermal noise.[17] Anaxagoras held that we can hear better at night than by day because during the day the heat of the sun causes the air to crackle and therefore renders coherent sound less distinct. We know nothing of the reasoning which led Anaxagoras to this statement. He certainly thought that the sound we hear is a disturbance propagated through air, and in Anaxagoras' explanation of lowered audibility by day we find him relating heat to sound. It is impossible to tell whether this explanation reflects a genuine theory of thermal noise in which the noise is attributed to the random motion, induced by heat, of parts of the air, or of fine particles suspended in the air; or whether it derived from the simple analogy between the crackling emitted when things are heated by a fire and the assumed noise emitted by air when it is heated by the sun. Either way the explanation is only partially correct. There does indeed exist a background of thermal noise due to the sun during the day, but this noise is by no means sufficiently intense to produce a noticeable effect on the clarity with which sound is transmitted and heard. Much more important is the higher external noise level which exists due to the generally greater amount of noisy activity going on during the day.

Chapter Eight

ASTRONOMY

Nowhere is Anaxagoras' belief in the unity of nature more evident than in his astronomical theories. He was convinced that the same kinds of matter are found in all parts of the universe, that they all behave according to the same physical laws regardless of where they are located, and that he was justified in applying the results of his terrestrial investigations to the explanation of celestial phenomena as well.[1] It was therefore a cornerstone of his thinking that, if at all possible, no astronomical theory should involve any special new substances or mechanisms not used in the earthbound part of his system. This aspect of his scientific thought was probably the best known of all to scientists who knew his name throughout the ages.[2]

This demand for unity in nature led Anaxagoras to say that the sun is a blazing object similar to the earth in its composition. Specifically, he said the sun is a red-hot mass of metallic ore[3]—perhaps because it glows much as does molten ore in a furnace. We do not know how he explained the fact that such a heavy body stays up in the heavens and does not fall. He may have viewed the daily rotation of the sun and the other heavenly bodies as vestiges of the churning motion that prevailed during the creation of the world.[4]

Anaxagoras' conception of the nature of the moon was somewhat different. He thought of the moon too as being much like the earth in its composition, but held that it does not give off its own light but shines instead by the reflected light of the sun.[5] On the basis of this view he would have been able to give a fairly complete explanation for the phases and eclipses of the moon provided he assumed also that the moon was nearer the earth than the sun. Unfortunately we do not know if he made this assumption nor have we any reliable reports from which we could conclude that he constructed a theory of lunar phases or eclipses. All we know is that he explained the faint image of the full outline of the moon which is seen soon after the new moon, the dimly illuminated disk which is half encircled by the bright thin crescent of the nascent moon, and which is therefore popularly called "the old moon in the new moon's arms," as being due to the presence of a small amount of residual sunlight left over from the previous month.[6]

Sunlight also played a role in Anaxagoras' explanation of one of the most striking phenomena of the night sky, the Milky Way.[7] The band of white light which stretches across the sky and changes position relative to the horizon from season to season long baffled people. The name it is commonly given derives from a myth which told that it was a stream of milk; but other explanations were also offered. Anagagoras' explanation of the Milky Way was unique among these in that it combined a number of fundamental principles of physics: the principle of economy in nature, the laws of optics, and the principle of spherical symmetry, or isotropy, of the universe relative to the earth taken as the center. We have seen that Anaxagoras held that there is an isotropic distribution of matter outside the earth, especially in the more distant outer regions. This spherical symmetry he held to be a fundamental property of nature.[8] In accordance with it, he concluded that the distribution of stars in the sky is completely isotropic, and that all parts of the heavens have the same density of stars.

To avoid introducing new *ad hoc* hypotheses, Anaxagoras denied that the Milky Way is different in any way from other heavenly bodies, but maintained that it consists of stars just like the rest of the stars that shine in the sky. However, since the band of the Milky Way is far brighter than its surroundings, the density of the stars in it must be much greater than the density of stars in the rest of the sky, in contrast with the isotropy just demanded above.

The only way for Anaxagoras to resolve this apparent conflict between the requirements of the law of symmetry in nature and those of the principle of economy was to find a mechanism which would explain why one part of the sky looks brighter than another though all parts contain the same number of stars. The explanation clearly lay in the realm of optics, and there Anaxagoras found it. During the day no stars are seen in the sky though everybody knows that they are present. The reason they are not seen by day is that the sun outshines them. Anaxagoras could thus explain any lack of isotropy in the observed distribution of stars as due to the presence of a fairly strong source of light, which outshines some stars and lets others appear.

Anaxagoras believed that the same sun that masks the light of the stars during the day is responsible for the apparent unevenness of their distribution at night. The sun under the earth at night shines on most of the stars in the night sky, though more faintly than by day. The reason the sun's light does not have sufficient intensity to hide all the stars at night as it does during the day is that at night the sun is beneath the earth, and hence so much farther away from the stars above. Therefore, the bright stars remain visible and only the dim ones are hidden from view. The part of the heavens on which absolutely no sunlight falls is the part which lies in the geometrical shadow of the earth. There *all* the stars are visible, the weak ones as well as the bright ones. According to Anaxagoras the stars which lie in the band defined by the shadow of the earth form the band of the Milky Way, and the density of stars observed in the Milky Way is, by the principle of isotropy, the true density of stars throughout the heavens.

Anaxagoras' theory of the Milky Way provides us with a large-scale example of his conviction that light always travels in straight lines. His explanation required him to believe in the rectilinear propagation of light even on a cosmic scale. Otherwise it would have been impossible for him to assume that a well-defined shadow of the earth extends across the heavens.

Anaxagoras also accounted for comets by means of familiar entities and mechanisms.[9] Instead of introducing some new kind of celestial body into his theory, he chose to explain the appearance of comets in terms of other heavenly bodies well-known to everybody.

To the naked eye a comet looks like an extremely small streak of light in the night sky, like nothing more than a slightly extended source of light. It looks very much the way two distant point sources of light look if they are so close to each other that they cannot be resolved by the eye into two separate images. Now planets change their positions relative to the fixed stars and relative to one another. In particular, they are capable of coming so close together in the sky that the eye can no longer distinguish them, but sees instead a small bright streak looking like an extended source of light. Because of this Anaxagoras assumed that what we call a comet is actually a conjunction of two or more planets. In this way he rendered a completely obscure phenomenon intelligible in terms of familiar things.

Although we possess only these few remnants of Anaxagoras' astronomical theories, all of them show clearly the way in which he approached the subject: in each instance he strove to reduce the amazing and the obscure to the familiar, the natural, and the commonplace.

Chapter Nine

EARTH SCIENCES

It is not unusual for hail to fall in the summer as well as in the winter. This has always been a source of great puzzlement, because one would expect that water can not freeze out of doors in warm weather. A theory of hail-formation must show how it can. Anaxagoras began from the observation that the higher up you go the colder it gets.[1] From this he deduced that water could freeze at very high altitudes even in the summer. All he had to explain was how water-laden clouds got to altitudes high enough to enable them to freeze.

Anaxagoras knew that heat causes things to rise and creates convection currents in the atmosphere.[2] It was therefore quite natural for him to assume that the heat of a summer day can drive clouds up to extremely high altitudes, whether by heating the clouds themselves and making them less dense and thus able to rise, or by causing the clouds to be pushed up by rising air currents. Once they reached sufficiently high altitudes, the clouds would presumably find themselves in surroundings cold enough to cause water to freeze. As a result, the water in the clouds would freeze and fall as hailstones back to earth. According to this explanation, it would not be surprising for hailstorms to occur even on the very hottest days; for the main effect of the intense heat might well be to drive clouds upwards more rapidly and so to give rise to a swifter and more effective process of condensation.

Anaxagoras explained the drop in temperature with altitude as due to the progressive decrease with height in the intensity of sunlight reflected from the surface of the earth. Apparently he assumed that together the directly incident sunlight and the sunlight reflected from the earth's surface are responsible for the temperature of the regions of space on which they fell. Since it was natural to suppose that sunlight reflected from an uneven surface would spread out equally in all directions, he concluded that its intensity must drop as one got farther from the earth. Since, then, the reflected component of sunlight diminishes as one goes higher, the temperature must diminish as well. This decrease eventually stops and is replaced by a progressive increase in temperature as the outer regions of burning-hot aether are approached; but the reversal occurs beyond altitudes which are meteorologically significant.

According to Anaxagoras, however, aether sometimes enters regions in which weather phenomena occur. For him thunder and lightning were both caused by falling aether.[3] Indeed he thought they resulted from a single event, an insight which in itself was not trivial, or by any means universally shared by his contemporaries and successors. He held that when some aether falls it gets caught in the clouds and burns in the atmosphere with a fiery glow which we see as lightning. Since the clouds contain moisture, this fire is instantly extinguished to the accompaniment of a great, loud, sputtering noise which we hear as thunder. This explanation is in complete agreement with the fact that lightning is always perceived before thunder; for fire must be present before it can be extinguished.

Again we see how unwilling Anaxagoras was to introduce a new substance into his theory. Rather than do so he ascribed the flashes of light he saw in the clouds during thunderstorms to the burning glow of fire which he always identified with the presence of bright, blazing light, whether in a fire, or on the sun, or anywhere else. Lightning was thus for him nothing else than another instance of fire. Moreover, Anaxagoras insisted that the actual circumstances should conform exactly to the observed data, so that whatever the events that constituted thunder and lightning, they had to occur in the order in which they are seen.

The difficulty in this theory is that it involves an unpredictable fall of aether from the distant outer regions, where it is normally found, to the atmosphere.[4] Anaxagoras gave no reason, no physical mechanism, for this striking, abnormal behavior of aether. Aether is the hottest and lightest of all substances, and therefore should always tend to rise if left alone. The entire theory of hail formation depends on the natural upwards tendency of hot things. In the case of thunder and lightning we are unexpectedly confronted with a situation in which a piece of aether falls, although not the least cause is given for this erratic behavior, and no indication of the way one might tell when the fall would occur. If however this arbitrary behavior of a hot substance is assumed, the rest of the theory follows naturally.

The hypothesis of falling aether was also used by Anaxagoras to explain the occurrence of earthquakes, together with their attendant phenomena.[5] Earthquakes are frequently accompanied by volcanic disturbances in which flaming gases and burning-hot substances of all kinds are belched forth from the earth and rise upward. The violence of these geological upheavals suggests that they are in some way caused by the build-up of tremendous pressures under the surface of the earth, pressures possibly originating in the hot substances that sometimes burst forth during and after the tremors. Anaxagoras knew pent-up gases are able to exert a considerable force,[6] and also that hot gases tend always to rise. From this he reasoned that earthquakes are caused by quantities of hot aether trapped underground, which try to force a passage upward until they succeed in rending the earth and escaping. As in the case of thunder and lightning, here too Anaxagoras gives us no clue as to why or how the aether falls from its usual place in outer space to the regions under the earth. Here the omission is more glaring than before, since the two physical mechanisms involved in earthquakes are in contradiction; earthquakes are caused by the upward tendency of aether, a tendency which must be temporarily inoperative when aether falls.

Although we are not told how aether gets underground Anaxagoras did explain how it is trapped until it manages to break a path to the upper air. He noticed that the surface of the earth is quite porous and pocked: it is filled with caves, caverns, subterranean vaults, and pits; it is cleft with fissures from which gases are constantly escaping; and even the soil is porous enough to allow water to seep down slowly. Once the hot aether has fallen into one of the cavities in the earth it does not easily find its way out again because most of the openings to the air above the earth are stopped up with caked mud which has been formed by rains; so that the aether can not rise vertically upward and escape straightaway. Instead it remains trapped until it either finds a way out, or, augmented by additional amounts of fallen aether great enough to exert the pressures required to break out of the enclosure, bursts out and shoots upward in a spectacular display of fireworks and tremors.

We see then that no special subterranean furnaces, no demons, no fires of the underworld were postulated by Anaxagoras in order to account for these terrifying catastrophes. He saw in them the workings of the same burning-hot aether which serves to explain so many phenomena in his theory.

Anaxagoras also concerned himself with one of the major geographical puzzles that has been a source of wonder since the earliest times: the annual overflow of the Nile during the summer.[7] He held that the Nile rises in the summer because it is swelled by the runoff from snows which melt in the spring. He did not specify where these snows were located, and later generations were free to imagine them as far east as the Hindu Kush, as far west as the Straits of Gibraltar, and as far south as the mountains of Ethiopia.[8]

Chapter Ten

BIOLOGY

Anaxagoras' detailed biological theories are not our main concern. Nevertheless we shall briefly discuss those that we know, because they illustrate his method of scientific inquiry, and for the more important reason that in general so few of his theories have survived that any added insight into his method is welcome.

In the complex domain of living things one of the chief ways of determining the function of an organ is by analogy between one animal and another. Anaxagoras drew such an analogy to determine the function of gills in fish.[1] Gills are observed to swing back and forth rhythmically. Their motion immediately suggests that they are playing a role in the function of breathing, except that it seems highly improbable that water contains air for the fish to breathe. For Anaxagoras this posed no problem, in view of his belief that all substances contain hidden in them some molecules of all other substances. Thus according to him water contains molecules of air which can be extracted from it by means of a proper device.

Anaxagoras explained that the gills are organs precisely suited to perform this task, and that they extract air from water by a kind of suction process: each time the fish expels water from its mouth, its gills extract air from the surrounding water, in order to fill the vacuum left by the departing water. The fish then inhales this air into its lungs, and so manages to breathe as do land animals. Land animals are unable to breathe under water by expelling water from their mouths, since they lack the essential organs, the gills.

Anaxagoras was convinced that not only do all animals breathe, but also all plants.[2] He noticed that plants share with animals other characteristics[3]: they too are highly organized complexes which can impose a degree of organization on their surroundings, as they do for example when they build tissue out of food. Furthermore, plants seem to react to stimuli: they move towards a source of light; they extend their roots towards water; and they frequently open and close their leaves or flowers in response to external excitation. These movements appear very similar to manifestations of desire and will in animals. All the characteristics which seem to be common to plants and animals led Anaxagoras to assume that plants, like animals, contain within them a mind.[4] Nature thus exhibited for him yet another degree of uniformity in that all living organisms without exception carry out all the same life functions, and possess Mind.

The unity of the living world in Anaxagoras' theory is so complete that there seems to be no criterion for differentiating between man and the rest of the plant and animal kingdom. In fact Anagoras saw little fundamental difference. He said merely that what distinguished man from other living things is one of the most evident physiological distinctions, man's hands.[5] These alone, according to Anaxagoras, enable man to outstrip even the most advanced of the animals in the manipulative skills and technical ability which give him the appearance of wisdom.

Anaxagoras was not however so committed to the concept of unity in nature that he suppressed observational data that seemed to contradict it. Two curious biological theories survive in which he relied on his observations so completely that he felt constrained to introduce peculiar assumptions which applied only to the case at hand. One of these concerns the sexual behavior of crows and ibises, the other concerns the reproduction of the weasel which was the counterpart of today's domestic cat among the ancient Greeks.[6]

Cats are rarely seen in the act of parturition, for when they are about to give birth they go to some remote and hidden spot in order to be free from disturbance. Immediately afterwards they eat the afterbirth and lick the entire area clean; after which they transport their newborn young to their permanent abode. Thus, immediately after delivery, cats with blood-stained mouths and faces can be seen carrying their very small young from the place where they have given birth. On the basis of such observations Anaxagoras concluded that weasels alone of all animals give birth through the mouth. Anaxagoras also maintained that crows and ibises are unique in that they have sexual intercourse through the mouth. He said this because these birds, though very common, are virtually never seen mounting, while they are frequently seen "kissing" beak to beak. In both instances Anaxagoras slavishly followed observational data, but he did not collect his data carefully enough. One might have hoped that Anaxagoras, faced with two such remarkable exceptions to the general rule in the animal kingdom, would have pursued the problem further and subjected the behavior of these animals to closer and more intensive scrutiny.

Three other isolated statements made by Anaxagoras on biological matters have come down to us without their context and totally unconnected with any observation or theory that we know of: (1) Anaxagoras said that the sex of a child is determined by the father alone. If the sperm issues from the right testis it develops in the right side of the womb, and a male child is born, whereas if the sperm issues from the left testis it develops in the left side of the womb, and a female child is born.[7] (2) He held that bile causes acute diseases when it overflows the gall bladder and spatters on the internal organs.[8] (3) He also held that the seeds of plants require sunlight in order to be able to sprout and that it is therefore necessary for them to be wafted through the air on their way to the ground so that they may be exposed to the sun.[9]

Compared with his physical theories, Anaxagoras' biological theories for the most part were not preserved in any detail, or within any general framework. But he was not primarily a biologist and clearly did not give the attention to biological investigations that he gave to physical and astronomical ones.

Epilogue

Anaxagoras' natural philosophy consists of postulates and laws formulated with the aim of explaining the behavior of the physical world rationally. At the root of his system lies careful observation of nature, and where simple observation failed, he sought to devise experiments in order to test his hypotheses and make his conclusions accessible to the public. The data he gleaned from observation and experiment made up the subject matter he explained in his theories.

Anaxagoras did not concern himself primarily with religious or ethical matters, nor did he spend his time speculating about realms not known to man through direct sensory perception. He made no attempt to connect natural phenomena with social justice or moral principles. His world was the world around us, and his *explicanda* were the physical events he perceived. Given these, he tried to set them into a pattern and to relate them to one another by placing them in a logical framework.

Anaxagoras was not satisfied with giving particular explanations to cover each of the different kinds of events that take place. He tried instead to discover unity in nature and so to comprehend as many diverse phenomena as possible within a single law. In his concept of Mind he gave the ultimate expression to this desire for unity and economy in science, although with his theory of Mind he achieved little more than unity of name; but his specific theories too afford many examples of the way in which this desire guided his thought.

Anaxagoras also made use of the concept of symmetry in his theories. The assumption of spherical symmetry in particular allowed him to deduce the nature of one part of the surrounding universe from another. More important yet to Anaxagoras' system of thought was the method of constructing theories by analogy, by which the functioning of the universe as a whole was compared to that of specific entities within it, and the behavior of one specific entity was compared to that of another.

We see then that Anaxagoras began from observation, or, where he felt it necessary, from experiment; that he explained his observations by setting them in a logical framework; that he insisted always that his theories conform to observed data; that he sought a minimum number of explanations to account for all phenomena; and that, to further this sought-for economy of thought, he used the concept of symmetry and the method of analogy as well. Most of the elements of what we today call scientific method were thus to be found in the work of this man whom later generations rightly acclaimed to be the first to speak "like a sober man" after "the stammerers who preceded him."[1]

Part Two

The Ancient Sources

These things are not stated explicitly or clearly. Still Anaxagoras' words imply views which resemble those of later thinkers, and are not even inconsistent with the most modern ones.

Aristotle *Foundations of Scientific Thought* 989b19-21 (source 67)

PLATO

c. 429–347 B.C.E.

1

Socrates' Defense of Himself to the Athenians (Apologia) 26d1

SOCRATES. . . . Don't I believe, just like everyone else, that the sun and the moon are gods?

MELETUS. By Zeus, he does not, citizen jurors! He says that the sun is stone and the moon is earth.

SOCRATES. Do you think you are prosecuting Anaxagoras, my dear Meletus? Have you such contempt for these people, and do you think them so illiterate they do not know that Anaxagoras of Clazomenae's books are full of such statements? But no, you say the young men learn these doctrines from *me*, since they can, for the cost of a drachma at most,[1] pay to have them delivered by a Socrates from the stage,[2] and have a good laugh at him there when he pretends that these teachings—which sound even funnier then than they usually do—are his.

2

On Life After Death (Phaedo) 72c3

SOCRATES. . . . If all things would always be combining and nothing ever dissociating, then Anaxagoras' "all things together" would soon come about.

3

Ibid. 97b8

SOCRATES. Once, however, I heard someone reading aloud from a book he said was by Anaxagoras, that Mind is that which arranges and fashions everything. I rejoiced at hearing this account. It seemed, somehow, to be a fine thing to say that Mind fashions everything. I thought that, if this was so, Mind must arrange all things in the best way and manage each thing for the best; so that if one wished to find out why anything does or does not change, he would first have to find out the most perfect state for that thing to be in, or the best way for it to interact with other things. It would then follow that the only worthwhile thing for a man to investigate about himself[1] and about the things around him would be what is most virtuous and what is most perfect, for each, respectively. At the same time, one who knew what is best would, necessarily, also know what is worst, since both follow from the same study.

I followed this reasoning with great joy, and thought that in Anaxagoras I had found a man who explained things after my own mind. I thought he would tell me whether the earth is flat or round, and after he had told me, he would go on to tell why it had to be that way, by indicating the best shape for the earth and showing why it is best. Similarly, if he said that the earth is at the center, I expected him then to explain that it is there because the best position it can have is at the center. Indeed, I was prepared to desire no other kind of explanation, if only he would make these things clear to me. In the same way, I was ready to inquire about the sun, the moon, and the other heavenly bodies, to determine their comparative speeds, their behavior, and the phenomena in which they are involved, so that I could then find out why the way each of them behaves is the best way.

Since Anaxagoras said all things are arranged by Mind, I never expected him to offer any other explanation for natural phenomena than that the way they are is the best way for them to be. I thought he would give an account of the best state for one thing and then for another, until he had covered each individual object, and then would go on to explain what the best state is for the universe as a whole. In fact, I would not have given up my expectations for all the money in the world. So I laid hold of the books eagerly and read them through as fast as I could so that I might learn as quickly as possible what is best and what is worst.

My friend, I was soon disillusioned. When I read on, I found in him a man who neither makes use of his Mind nor introduces any other real entities to take its place as the source of order in things, but offers instead as explanations gases, ethereal substances, liquids, and many other ludicrous things. It is as if someone said that Socrates does everything he does according to the dictates of his mind, and then tried to give the reason for my particular actions by saying that I am sitting here because my body is made up of bones and muscles—my bones being rigid and linked by joints, while my muscles are flexible and cover my bones—along with flesh and skin which holds them all together; and because my muscles, relaxing and contracting, lift my bones at the joints and enable me to bend my limbs at this moment; so that this is the reason I am now sitting here with my limbs bent. He would give similar reasons for my conversing with you, namely, sound and air and hearing and ten thousand other things. But he would neglect to give the true reasons: that since it seemed best to the Athenians to condemn me, it seems best to me now to sit here; for I think justice demands that I wait and suffer whatever judgment they impose on me. By the Dog, I think these muscles and bones would long since have been in the land of Megara, or in Boeotia, carried there by what they think is best, if I had not thought that it was more just and more virtuous to accept any judgment the city might impose than to turn and run away.

It is certainly ridiculous to call such things explanations. If someone said that without such things as bones, muscles, and anything else I happen to have, I would not be able to carry out what I think best, he would surely be right. But if someone acknowledged that my mind controls my actions, and still maintained that I act as I do, not because I choose the best course, but because I have bones and muscles, his reasoning would be sloppy indeed; for the inability to distinguish a real cause from the implements necessary to achieve a result—I think that is why the majority of people grope in the dark and confuse their terms, calling such things explanations! Thus, one man says that the earth remains motionless beneath the heavens because it is surrounded by a vortex, while another says that there is air underneath it which supports it as a pedestal supports a flat kneading-trough. But neither investigates the force which causes things to be disposed in the best way possible and neither believes that it has any exceptional power. They think it likely that some Atlas will turn out to be stronger, more immortal, and more capable of holding all things together; in fact, they do not think that perfection and proper coordination can be the source of unity and coherence in anything at all. But I would gladly be a student of anyone who could give me lessons in this kind of explanation.

4

On Etymology (Cratylus) 400a5

SOCRATES. Don't you think it is life alone which holds together and drives the entire body and so causes it to live and walk about?

HERMOGENES. Yes, I do.

SOCRATES. Well, then, you must agree with Anaxagoras that Mind (that is, life) arranges and holds together all other things.

HERMOGENES. Yes.

SOCRATES. Then it is entirely appropriate that the factor which holds together and drives the physical universe should, because of this function, receive the name *physechē*,[1] which we may pronounce more elegantly as *psychē*.[2]

HERMOGENES. Certainly. I think the latter form is far more artistic than the former.

SOCRATES. It is indeed, and, to tell the truth, it seems utterly ridiculous to use the etymological form of the word.

5

Ibid. 409a6

HERMOGENES. And what about the word for 'moon'?[1]

SOCRATES. It seems that it puts the squeeze on Anaxagoras.

HERMOGENES. Why so?

SOCRATES. He is like a man who tells a timeworn tale. For he announced only recently that the moon receives its light from the sun.

HERMOGENES. How is it a timeworn tale?

SOCRATES. *Selas* and 'light' mean essentially the same thing, don't they?

HERMOGENES. Yes.

SOCRATES. Now, the light around the moon is always new and old, if the followers of Anaxagoras are right. For the sun, going about it in a circle, always adds new light, and the old light of the previous month still remains.[2]

HERMOGENES. Certainly.

SOCRATES. And it is true that many people call the moon *selanaia*.

HERMOGENES. That's right.

SOCRATES. Now, since it always has new and old brightness it could quite aptly be called *selahenoneoaeia*,[3] except that the word becomes contracted to *selanaia*.[4]

HERMOGENES. A very dithyrambic name, Socrates.

6

Ibid. 413c4

SOCRATES. . . . and someone else claims . . . that Anaxagoras is correct, and Right Rule is one with Mind. For Anaxagoras says that Mind is autonomous and free from admixture, and that it passes through all things and bestows order upon all things.[1]

7

On Love (Phaedrus) 269e1

SOCRATES. My good friend, Pericles was probably the most accomplished speechmaker[1] of all.

PHAEDRUS. Why is that?

SOCRATES. Idle chatter, and physical inquiries dealing with things up in the air are indispensable to all the august professions. It looks as if that kind of thing is the source of their lofty thinking and perfect action—traits which Pericles acquired over and above his natural gifts, since he fell in with Anaxagoras, who was that sort of man. Thus he became filled with up-in-the-air things and came to understand Mind and Mindlessness,[2] Anaxagoras' favorite subjects. This, doubtless, is where Pericles got all that terribly appropriate material he grafted onto the technique of rational thought.[3]

8

On the Education of a Statesman (Alcibiades I) 118c2

ALCIBIADES. They say that Pericles did not become wise all by himself, Socrates, but that he used to get together with Pythoclides, Anaxagoras, and many other wise men. Even now, when he is old, he still sees Damon.

9

The Lovers (Amatores) 132a3

SOCRATES. Two of the boys happened to be arguing, but I could not quite hear what was going on. It seemed, however, that they were arguing either about Anaxagoras or about Oenopides, for it looked as if they were drawing circles with their hands and indicating various angles of inclination of the earth. At any rate, they were completely absorbed in what they were doing.

10

On Rhetoric (Gorgias) 465c8

SOCRATES. . . . Suppose that the body was autonomous and not controlled by the life within it so that the life within it did not distinguish, through its capacity to know, the art of cooking from the practice of medicine, leaving it to the body to measure and evaluate them according to the pleasures they afford it. The state of affairs Anaxagoras speaks about would then prevail, my dear Polus—and you are well acquainted with that state: all things would be mixed together into one big mess, so that there would be no distinction or separation between the things with which medicine deals, the things which tend to bring about health, and the things with which the art of cooking deals.

11

On the Noble and the Base (Hippias Major) 281c2

SOCRATES. Hippias, what can it be that has kept all those who have a great reputation for wisdom, or at least most of them, from participating in politics—not only those known from antiquity, like Pittacus, Bias, and Thales of Miletus and his school, but even almost all the more recent ones up to and including Anaxagoras?

12

Ibid. 283a4

SOCRATES. Anaxagoras' experience is just the opposite of yours. They say that when a great quantity of money was left to him he neglected it and lost it all—such was the mindlessness his cleverness amounted to!

13

The Second Letter (Epistula II) 310e5

It is natural for wisdom to be in league with power; indeed, wisdom and power always run after one another, seek out one another and have intercourse with one another. It is the type of thing people get all excited about: they talk of it themselves in private conversations and they love to hear about it from others in literary works. For example, whenever people mention Hieron, and Pausanias the Spartan, they love to bring up their friendship with Simonides and tell of the favors he did for them and the things he said to them; and they praise Periander of Corinth along with Thales of Miletus, and Pericles with Anaxagoras . . .

XENOPHON

c. 430–354 B.C.E.

14

Memories of Socrates (Memorabilia) 4.7.6

Socrates said that anyone who worried about heavenly bodies would probably become as crack-brained as Anaxagoras, who was so proud of his explanations of the workings of the gods. Yet Anaxagoras did not realize, when he said that the sun is really fire, that you can look easily into a fire but you can not fix your gaze on the sun; that sunshine tans the skin but fire has no such effect; and that sunshine makes plants thrive, while a fire's heat consumes them. And in calling the sun a red-hot stone he showed that he did not know that a stone placed in fire does not shine or even maintain itself for long, while the sun is the brightest of all objects for all time.

ISOCRATES

436–338 B.C.E.

15

Plea Concerning an Exchange of Property (Antidosis) 26.20

Pericles studied with two men: Anaxagoras of Clazomenae and Damon . . .

DEMOSTHENES

384–322 B.C.E.

16

Oration on Love (Eroticus) 45

You will hear that Pericles, who apparently possessed the most penetrating mind of his generation, sought out Anaxagoras of Clazomenae, associated with him, and so became adept in philosophy.

ARISTOTLE

384–322 B.C.E.

17

Physics (Physica) 187a20

The second group of physicists holds that all attributes are at first blended together in the universe and then become distinguished from one another. This is the view of Anaximander, and also of those like Empedocles and Anaxagoras who assume the existence of a single undifferentiated material mass as well as of many discrete objects. For Empedocles and Anaxagoras also hold that things emerge from a universal mixture but they differ in that one says the emergence occurs in cycles while the other says it happened only once. In addition, one posits the existence of an infinite number of things—molecules of various substances[1] along with pairs of contrasting qualities[2]—while the other posits no more than his so-called elementary kinds of matter.

It seems that Anaxagoras thought that the basic components of the universe are infinite in number because he accepted the common opinion of physicists, that something can not come out of nothing (whence physicists concluded that all things always coexisted and that all physical change is either qualitative change plain and simple,[3] or else a process of dissociation and recombination); and also because of the fact that an object passes from one state into its opposite, from which he concluded that the second state must have existed in the first. For since the followers of Anaxagoras assumed that things must come to be either out of things which existed previously or out of nothing, and since—as all natural philosophers acknowledge—the second alternative can not be true, they concluded that everything that comes to be must have existed before, but in pieces which were imperceptible because they were so small. Thus, they believe that all things are mixed in everything because they observe that everything comes to be out of everything.[4] They say, further, that things differ from one another in appearance and in name, according to the most numerous component in the mixture of numerically infinite components which makes up each thing; for there is no object which is purely white or black or sweet or flesh or bone; rather the appearance of each thing is determined by its predominant component.

Now, since anything infinite can not be grasped because it has no limits, it is impossible to determine the measure of an infinite number or magnitude; and it is impossible to determine the nature of an object which is subject to infinite variation of quality.[5] Accordingly, if the basic constituents of the universe display infinitude of number and variety, it is impossible to know anything composed of them, since we say we know a composite object when we know the number and nature of its components.

Again, it follows that an object can be of any size whatever if its component parts—where I mean by 'component parts' actual subdivisions of the whole into which it can be broken up—can be of any size. Therefore, since a plant or an animal can not be of any size whatever, it is clear that any component part of a plant or an animal can not be of arbitrary size. For if any part could be, so could the whole. Now, flesh and bone and other tissues are component parts of an animal, as is vegetable matter of a plant. Therefore, it is clearly impossible for flesh or bone or anything else[6] to be of arbitrary size.

To continue, if parts of all these things are actually present in all things in this way, a contradiction follows: for if we grant that a thing does not really come to be, but emerges from what previously contained it, and is named after its predominant component; and if we grant that anything can come to be from anything else by a process of extraction—for example water from flesh and flesh from water—and that a finite volume can contain only a finite number of objects of finite size; then it can not be that each and every thing exists in each and every thing. If flesh could be extracted from water and if the extraction could go on without end, even if ever smaller pieces of flesh were to be removed from the water, the extraction would still eventually have to end since there is a lower limit to the size of the pieces of flesh which could be extracted.[7] Accordingly, it is not true that everything is in everything, since there would be no flesh in the rest of the water when the extraction came to an end.

On the other hand, if the extraction of flesh from water did not end, and if it were always possible to remove more flesh from the remaining water, then there would have to be an infinite number of similar finite particles in a finite volume, which is clearly impossible.

In addition, since every object becomes smaller when something is taken away from it, and since flesh can exist only within a limited range of sizes, it is obvious that nothing of any size can be taken away from the smallest piece of flesh which can exist. For if it could, the remainder would be less than the minimum size.

Moreover, according to Anaxagoras, even in the infinitely numerous material constituents there should exist as real and distinct entities an infinite number of pieces of flesh and blood and brain,[8] each one in turn composed of infinite subdivisions—which is surely absurd.

Anaxagoras says correctly, but without real comprehension, that no separation can ever be complete. It is true that attributes can not be divorced from objects. For if colors and states could be separated from a mixture containing them, pure whiteness or pure health would exist, independent and not predicated of any object.[9] His Mind, then, is foolish since it attempts the impossible. For its aim is to separate, but the task it sets itself is impossible to accomplish. It is impossible as far as measure is concerned, because there is no such thing as a smallest size in Anaxagoras' theory. And it is impossible as far as qualities are concerned because attributes are inseparable from objects.[10]

Then again, Anaxagoras' assumptions about the composition of homogeneous objects are incorrect. True, from one point of view mud is composed of pieces of mud; but from another it is not. Again, water does not come to be from air, or air from water, in the same way as building-blocks do from a house, or a house from building-blocks. It is better to assume the existence of a smaller, finite number of elementary kinds of matter, as Empedocles does.[11]

18

Ibid. 189a16

Empedocles thinks he can account for all things with a finite number of elementary kinds of matter, while Anaxagoras thinks an infinite number necessary.

19

Ibid. 196a17

. . . None of the ancient thinkers included Chance as a primary concept in their theories, in the way they included Affinity, Repulsion, Mind, Fire, and such things.

20

Ibid. 198b12

Everybody thinks a phenomenon explained when it is shown to be in some way necessary. Thus, for example, they say that an object that naturally has a certain degree of heat or cold or any other quality is as it is and has become that way of necessity. Indeed people who provide any other explanation merely touch on it and then let it go, as when one introduces Affinity and Repulsion, or another introduces Mind.

21

Ibid. 203a19

Those who believe that there are an infinite number of basic constituents of matter—whether like Anaxagoras they identify them with molecules of various substances, or like Democritus with the mixture of differently shaped particles—all say that that which is infinite is composed of an infinite number of bodies in continuous contact with one another.[1]

Anaxagoras held that any object in the universe is a mixture just as the universe as a whole is, because he observed that everything comes to be from everything else. It seems that this is why he said that all things in the universe were once together: Just as any piece of flesh or bone or anything at all is a mixture of all things, so all things in the universe were once mixed—and all together, at that; for just as any process of extraction must begin at a certain time, so too the separation of all things out of the whole mixture must have begun at a certain time.[2] Now since anything which comes to be emerges from a mixture, and since *all* things come to be—except for the universal mixture from which all things came to be—there must be something responsible for all this coming to be. For Anaxagoras, there is one thing responsible, which he called "Mind," and Mind began its work when it started to think at a certain time. Accordingly, Anaxagoras concluded that all things in the universe were once together, and that at a certain time they began to move.

22

Ibid. 205b1

Anaxagoras says foolish things where he discusses why the infinite universe is stationary. He says that it holds itself in place because it is in itself; for nothing else contains it. This is tantamount to saying that any object is *always* in that part of space where it is naturally at rest, which is not true since a thing may be put somewhere by main force and so not be in a place where it is naturally at rest.

23

Ibid. 213a22

Those who claim to prove by experiment that there is no such thing as absolute emptiness are not dealing with the usual designation of "absolute emptiness" but rather with a mistaken one. This is what Anaxagoras and the others are doing when they perform experiments to "disprove the existence of a void." All they manage to prove when they twist wineskins and show that the air caught inside can resist pressure, or when they trap air in their water clocks, is that air is something substantial.

24

Ibid. 250b23

If it were possible that there ever was a time when nothing in the whole world moved or underwent change, this could only have happened in one of two ways: either the way Anaxagoras describes it—he says that all things coexisted in the universe at rest for an infinite time, and that Mind caused them to move and formed them into distinct entities; or the way Empedocles does . . .

25

Ibid. 252a3

. . . it is clear that motion and change are eternal. It is impossible that they existed at one time but not at another. To say otherwise is to fabricate a wild tale. Nor is it less absurd to hold that there can be motion and change at one time and not at another while also maintaining that motion and change are primary concepts in physical theory. . . . This view is . . . held by those who, like Anaxagoras, posit one thing which is primarily responsible for all things.

However, no process which takes place according to natural law is disordered; for natural law accounts for order in all things. Now, two infinite quantities cannot be related by a numerical ratio, while order always implies some numerical ratio. Accordingly, if we say that the universe was at rest for an infinite time and then began at a certain time to undergo change, and if it makes no difference whether this happened at one time or at another—so that we are in effect saying that the process obeys no law—then the whole thing has nothing to do with natural processes. In fact natural processes must either be invariant, i.e. not possess certain characteristics at one time and lack them at another—for example, fire is not sometimes carried upward and sometimes not—or, if they vary, the variation must be expressible in rational terms. Therefore it is better to say with Empedocles, and with anyone else who agrees with him, that alternately the universe is static, and undergoes change; for such a process at least obeys some law.

26

Ibid. 256b24

. . . Anaxagoras is right in saying that Mind, which for him is the source of motion and change, can not be affected and is free from admixture; for only if it never changes state can it originate motion and change, and it can only govern if it is free from admixture.

27

Ibid. 265b22

Anaxagoras says that Mind, which originated all motion and change, separates things into distinct entities.

28

Astronomy (De Caelo) 270b20

. . . implying that the uppermost regions consist of an elementary kind of matter distinct from dry dust, heat, colorless gas, and clear liquid, people give them another name, 'aether,' because of their property of continual motion through all time.[1] Anaxagoras, however, uses this word incorrectly; for he uses 'aether' when he means 'heat.'[2]

29

Ibid. 294b13

Anaximenes, Anaxagoras, and Democritus say that the earth's flatness enables it to remain stationary. They say that it does not fall through the air below but covers it like a lid. Indeed it often happens that a flat body is suspended in mid-air on a windy day because its flat surface offers resistance to the air pressing against it. These physicists say that the earth is similarly suspended because of the resistance its flat surface offers to the air beneath it. This air, unable to change its place—because it remains motionless under the earth—is sufficiently compressed[1] to support the earth. The case of water in water clocks is similar; and they bring much evidence to prove that air can bear a great weight when it is sealed off and stationary.

The first argument against them is that they say the earth is at rest only because it is flat, whereas the real reason they are giving for the earth's stability is not that it is flat, but that it is large. For they say that the earth traps a large volume of air because of its great size, and that because such a large volume of air is cut off the air remains motionless, having no escape. This would be so even if the earth were spherical, as long as it were large, for then too it would remain in its place according to their argument.

In fact, however, our objection to such views concerning motion is not simply a question of detail, but concerns basic principles. One of the first things to determine is whether or not a free body moves, in the natural course of events, and if not, whether one can still speak of constrained motion. We have already settled these questions to the best of our ability, and will treat the results of that discussion as known. We have determined that if there does not exist free motion in the natural course of events then there can be no such thing as constrained motion either. And if neither free nor constrained motion exists, there can be no motion at all. That these are necessary conclusions has been shown earlier. In addition we have determined that if there is no such thing as motion there is no such thing as rest, for just as motion is either constrained or free, so is rest. It is also obvious that as soon as one admits the existence of free motion in the natural course of events, constrained motion and constrained rest are no longer the only possible types of motion and rest. Now, as soon as you say the earth is now at rest at the center of the universe because of external constraint, it follows that earth must once have been brought together at the center by means of external constraint—e.g. some kind of churning motion. In fact this is the explanation they all give, citing as examples the behavior of liquids and gases, where larger and heavier objects are always carried to the center of an eddy. Consequently all those who say that the world was created say that earth had to be brought together at the center.[2]

Next, they must seek the reason the earth remains at rest. Some say, as we have seen, that the reason is the earth's flatness and size, and others, like Empedocles, say that the speed of the heavens' rotation is greater than the speed of fall of the earth and so keeps the earth from moving. He takes as an example the behavior of water in ladles: when a water-filled ladle is whirled around, the water is often below the cup of the ladle; but it does not fall, as it would normally, because of the speed of the rotation.

However, where would they have the earth go if the vortex stopped hindering its motion, or if some air crept around and the earth's flatness became ineffective? According to them, earth is forced to the center and rests there by constraint; it must, then, tend to move in some direction when left free. Would that direction be up, or down, or where? It must be somewhere! Their theories give no reason to prefer downward to upward motion, and they do not say that the air above the earth prevents it from being carried upward. Why then should the air below prevent it from being carried downward? Is it not absolutely necessary that the same cause must always have the same effect if all other conditions are the same?

30

Ibid. 301a11

. . . no process which obeys natural law is random. Anaxagoras seems to have understood this very well, for he says that before the universe was set in order it was completely static.[1]

31

Ibid. 302a28

Anaxagoras and Empedocles hold diametrically opposed positions on the kinds of matter which are elementary. Empedocles says that heat, dry dust, and his other elementary kinds of matter are the elementary material components of all things. Anaxagoras holds the opposite view. He says that molecules of various substances—I mean, like flesh, bone, and other such things—are the elementary kinds of matter, while colorless gas and heat are mixtures containing flesh and bone and all other particles, and indeed are made up of all the imperceptible molecules together, which is why all things can arise out of them.[1] (Note that Anaxagoras applies the words 'heat' and 'aether' to the same substance.)[2]

32

Ibid. 302b10

Our next task is to inquire whether the elementary kinds of matter are finite or infinite in number and, if they turn out to be finite, to determine how many there are. First we must show that there can not be an infinite number, as some maintain.

Let us consider first those[1] who say that all kinds of molecules are elementary, in the way Anaxagoras does. Anyone who takes this view does not correctly understand what an elementary constituent is. We see that even compound substances—I mean, like flesh, bone, wood, and stone—are composed of molecules. A compound, however, is not elementary. Therefore, not every molecule is elementary, but only those which can not be further broken down into dissimilar components, as we have explained earlier.[2]

Then again, even if we accept this definition of 'elementary constituent,' it is not necessary to assume that there are an infinite number of them. All the same phenomena can be explained in terms of a finite number, for the same results can be obtained if only a few[3] elements are posited, as in Empedocles' theory. Indeed, even an infinite number of elementary constituents does not make it possible for these physicists to hold that everything is made up of particles having the same properties as the substance in mass; for not even they hold that a face is made up of little faces, or that anything else inherently possessing a characteristic shape is made up in such a manner. . . .

33

Ibid. 309a19

Anaxagoras, Empedocles, and some of the others who deny the existence of a void do not specify what it is that distinguishes lightness and heaviness.[1]

34

On Physical Change (De Generatione et Corruptione) 314a11

. . . Empedocles, Anaxagoras, Leucippus, and others who say that there are various kinds of matter necessarily distinguish between coming to be and change of quality. Anaxagoras, however, did not understand the implications of his own words, for he identified all physical change with qualitative change,[1] though he was one of those who held that there are many kinds of matter.

Empedocles says that there are four basic kinds of matter. If we include the sources of motion and change, his physical theory is based on six basic elements. Anaxagoras, Leucippus, and Democritus say that there are an infinite number of elementary constituents of matter. Anaxagoras holds that the fundamental constituents of matter are molecules of various substances like bone, flesh, marrow, and any other such thing, whose subdivisions are designated by the same word as the substance in mass. Democritus and Leucippus hold that everything is built up of indivisible particles, infinite in number and in shape, and that the differences between objects are due to the shapes of the particles which they contain and the order and orientation of these particles. The position of the school of Anaxagoras seems to be diametrically opposed to that of the school of Empedocles. The latter says that heat, clear liquid, colorless gas, and dry dust are the four elementary kinds of matter and that *they* are simple, rather than flesh, bone, and other such molecular varieties. The school of Anaxagoras, on the other hand, says the latter substances are simple, while dry dust, heat, clear liquid, and colorless gas are compounds, each being a mixture of all the different kinds of particles.

35

On the Inanimate World (Meteorologica) 339b21

The aether received its name long ago. It seems to me that Anaxagoras thought that the word 'aether' actually meant 'fire.'[1] He thought that the upper regions were burning hot, and that therefore it was appropriate to call the substance which prevails in those parts 'aether.' He was right to choose this name.[2] For it seems that the ancients assumed that the aether is an eternal substance whose motion never ceases,[3] and that it is in some way supernatural.[4] Hence they gave it the special name 'aether' since it is like nothing else we know.

36

Ibid. 342b27

Anaxagoras and Democritus say that a comet is seen when several planets appear as one body in the sky and seem, by virtue of their proximity to one another, to touch.

37

Ibid. 345a25

Anaxagoras and Democritus and their followers say that the light of the Milky Way is the light of stars. They say that when the sun passes underneath the earth it is not in the direct line of sight of all the stars in the sky. Now, stars which are in the line of sight of the sun can not be seen because their light is obscured by the rays of the sun. They say, then, that the stars in the earth's shadow, which are shielded from the rays of the sun, constitute the Milky Way.

38

Ibid. 348a14

Some people say that hail is formed under the following circumstances: a cloud is pushed up to a high altitude, whereupon the water in it freezes. (High altitudes are colder because the intensity of the sunlight reflected from the earth's surface falls off at great heights.) Therefore hailstorms occur more frequently during the summer or in warm places, for more heat is available to push the clouds up away from the earth.

As it happens, hail hardly falls at high altitudes, though on their premises it should—whereas we see that snow does usually appear at great heights. Again, we often observe that clouds are driven down to ground-level to the accompaniment of loud thunder, causing such terror among those who see and hear it that they expect some great catastrophe to follow. Sometimes however, even though no thunder is heard when such clouds appear, a violent hailstorm ensues. In such cases the hailstones which fall are incredibly large and asymmetric because they freeze close to the earth and fall for only a short time. This shows that the theory does not agree with the observed facts.

Now, since hail is ice, the more intense the factor which causes freezing, the greater the hail. For it is clear to everyone that the greater the cold, the greater the quantity of ice produced. But the fact that large hailstones are asymmetric shows that they must freeze close to the earth, for hailstones which fall from great heights become small and smooth as they are worn down during their long descent.[1] It is clear then that the freezing does not take place because the cloud is thrust into the cold high altitudes.

Now, we know from experience that heat and cold surround one another in layers, for below the surface of the earth it is cold in the summer and warm in the winter. The same thing doubtless occurs above the surface of the earth. Thus it sometimes happens in the warm seasons of the year, when warm air surrounds cold, that water quickly condenses in a cloud. This is the reason precipitation is heavier and storms more violent in the summer than in the winter. (They are called more violent when they are denser, and they are denser when the condensation is swift.)

Accordingly, precipitation occurs under circumstances diametrically opposed to those which Anaxagoras described. He said it happens when clouds rise into cold air, while we say it happens when they descend into warm air. . . .

39

Ibid. 365a14

Our next topic will be earthquakes and earth tremors, which also belongs in this course. To date, three men have proposed theories to explain these phenomena: Anaxagoras of Clazomenae, Anaximenes of Miletus before him, and most recently Democritus of Abdera. Anaxagoras says that, though aether normally rises, it sometimes falls into hollows beneath the surface of the earth. This aether causes the earth to stir because the upper crust of the earth is clogged by rains, whereas normally earth is uniformly porous. As if the globe has an upper and a lower side, and we happen to live on the upper side, while the other side is the underside!

Perhaps there is no need to argue against this theory because it is too simple-minded. It is foolish to suppose that up and down are absolute concepts; heavy objects are carried toward the earth from all directions and light substances, like fire, are carried away from the earth in all directions. Anaxagoras' view is especially foolish since anyone can see the horizon change as he changes his position, wherever he is on earth, as far as we know. This indicates that the earth is convex, and probably spherical. It is also foolish to say that the earth rests motionless on air because of its size, and then to assert that it is shaken through and through when struck from below. In addition, this theory fails to account for other features of earthquakes, for example, that they do not occur in every country or in every season of the year.

40

Ibid. 369b11

Lightning and thunder are being discussed.

. . . some people say that fire gets caught in the clouds. According to Empedocles, this fire trapped in the clouds comes from the rays of the sun. Anaxagoras says that it is carried down from the aether above, which he says is fiery heat. Its glow is lightning, and the sputtering noise it makes when extinguished in the clouds is thunder. According to him, then, lightning occurs before thunder, in the order in which they are perceived.

It is absurd to say (as do both these theories) that fire can be trapped. It is still more absurd to say that aether is pulled down from above. If you say that something which normally rises is carried down, you must give a reason; and you must explain why this happens only when the sky is overcast, and not all the time, since it does not happen in fair weather. The whole theory seems to have been tossed off without much thought.

41

Psychology (De Anima) 404a25

. . . Anaxagoras and the others who say that Mind is the source of motion in the universe hold that life is characterized by the ability to move. Democritus is entirely different: he simply says that to have life is the same as to have a mind, believing that what appears to be is really so;[1] and this is the reason Homer did well to speak of "Hector lying there out of his mind." For Democritus does not associate the mind with the capacity for conceiving truth, but rather always takes the possession of life to be the same as possession of mind. Anaxagoras however is less clear. He says often that Mind is the factor responsible for the proper order of things; but on other occasions he identifies Mind with life, as when he says that all animals—large and small, honorable and base—possess Mind. In fact, however, it seems that if Mind means intelligence, it is not only not a possession of all animals, but not even of all men!

42

Ibid. 405a13

As we have said above, Anaxagoras seems to imply that the possession of life and the possession of Mind are two different things. However, he generally treats them as if they were the same (except that he holds that Mind bears the primary responsibility for all things, saying that it is the only thing which is simple, free from admixture, and pure.) And he implies that both life and Mind—i.e. both perception and motion—originate from a single source, when he says that Mind was the source of motion in the universe.

43

Ibid. 405b11

Speaking loosely, all people use three things as criteria for the presence of life: the presence of motion, of perception, or of something incorporeal. Each one of these criteria is connected with basic elements of their theories. Thus, even those who say life is characterized by knowledge and perception[1] say that life *is* actually one of the basic constituents of the universe or a compound of them. All of them concur, except one; for all except one say that something can be perceived only by something else having the same properties. Since, according to them, life is characterized by the ability to perceive *all* things, they say that life is compounded out of all the elementary constituents of the universe. Accordingly, those who say that one thing explains the whole universe, i.e. that the universe is made up of only one basic constituent, say that life consists of that same thing, for example, of heat substance or of colorless gas. On the other hand, those who hold that there is more than one basic constituent say that life is compounded out of more than one kind of thing. Anaxagoras alone says that Mind is not subject to change and has nothing in common with anything else. He does not, however, explain how Mind comes to know

—that is, what mechanism enables it to know and perceive things—if it has nothing in common with anything else; nor can this be inferred from his writings.

44

Ibid. 429a18

. . . since Mind can understand all things it must be free from admixture in order that it may master all things, as Anaxagoras says—by which he means, in order that it may know them. Indeed, any foreign admixture would impede its action . . .

45

Ibid. 429b24

One might ask how Mind can think, if it is, as Anaxagoras says, simple, not subject to change, and completely different from anything else; for thinking is a kind of change of state . . .

46

On Respiration (De Respiratione) 470b30

Anaxagoras and Diogenes maintain that all living things breathe. They explain how fish and oysters do this. Anaxagoras says that when fish expel water through their gills air is produced in their mouths, since there can be no void. By inhaling this air they breathe.

47

Comparative Anatomy (De Partibus Animalium) 677a5

. . . It seems Anaxagoras and his school are no less wrong in assuming that an excess of bile causes acute diseases, when it spurts out on the lungs, blood-vessels, and ribs.

48

Ibid. 687a7

Anaxagoras says that man is the most intelligent living being because he has hands.

49

On the Reproduction of Animals (De Generatione Animalium) 723a7

Aristotle is discussing a theory which says that semen contains pieces of the various tissues of the body.

. . . This explanation seems to be the same as Anaxagoras' theory that none of the various kinds of molecules[1] come to be out of nothing. Anaxagoras, however, applies this theory everywhere, while the biologists apply it only to the reproduction and growth of animals. But how are the pieces which come from all over the body supposed to grow? At least Anaxagoras' theory of growth is reasonable: he says that there is flesh in food which is added to the flesh in the body.

50

Ibid. 756b14

Some people say that birds of the crow family, and ibises as well, have intercourse with their beaks and that, of the quadrupeds, the domesticated weasel gives birth through the mouth. Anaxagoras as well as some other natural philosophers hold these views, but in this they are too naive and do not take sufficient account of the evidence. In the case of crows and ibises, they deduced their erroneous conclusion from the fact that crows are seldom seen mounting, while they are often seen encountering one another beak to beak. All birds of the crow family do this, as can easily be observed in the case of tame jackdaws; pigeons and doves do likewise, but having also been observed to mount, they have not gained this reputation. Crows, however, do not frequently have intercourse and have few offspring. But by now even they have been observed mounting. In any case, it was foolish not to have wondered how semen can reach the uterus in these species if it must pass first through the alimentary canal, which digests everything passing through it, like food; for after all, these birds have a uterus and their eggs are found in the lower part of their bodies.

The domesticated weasel too has a womb just like other quadrupeds. How then does the embryo travel from the womb to the mouth? Anaxagoras came up with this theory only because the domesticated weasel, like other animals with separated toes—about which we will speak later—has very small young and often carries them about in its mouth.

51

Ibid. 763b27

It is a moot question whether or not the sex of an animal is determined before it can be clearly distinguished by observation—that is, whether sex is differentiated in the mother's womb, or before. For example, Anaxagoras and some other natural philosophers hold that sex is already determined in the sperm. They say that while the father provides the seed, the mother only provides a place for the foetus to develop; that male offspring come from the right testis and female from the left; and that furthermore, male offspring develop in the right side of the womb, females in the left.

52

Botany[1] *(De Plantis)* 815a15

Anaxagoras and Empedocles say that plants are swayed by desire, have sensation, and experience misery and gratification. For Anaxagoras said that plants are animals and experience misery and gratification, deducing this from the way they bend their foliage.

53

Ibid. 815b16

. . . Anaxagoras, Democritus, and Empedocles say that a plant has a mind and possesses intelligence.

54

Ibid. 816b26

A plant does not breathe. Anaxagoras, however, held that it does.

55

Ibid. 817a23

Plants derive nourishment from the earth, and their capacity for bearing fruit from the sun. This is why Anaxagoras said that seeds of plants are wafted through the air down to the earth . . .[1]

56

Problems in General Science (Problemata) 903a7

Why is it easier to hear at night than during the day?

Is it, perhaps, as Anaxagoras says, because during the day the air crackles, since it is heated by the sun, while at night when heat is absent it is quiet, so that there is no noise and one can hear better?

57

Ibid. 914b9

Anaxagoras' explanation for the way a water clock works seems in general to be correct: it is true that the air trapped in a water clock keeps the water out when the tube is stoppered. However, this air can not be the only factor involved, for if the water clock is submerged obliquely with its tube stoppered, water will enter. Therefore Anaxagoras' explanation of how the air keeps the water out is incomplete.

58

On Melissus, Xenophanes, and Gorgias[1]
(De Melisso Xenophane Gorgia) 975b11

According to Empedocles, various things can be formed when heat and the other elementary kinds of matter are mixed into compounds;

when these are dissociated and become distinct once again things are destroyed. Thus, although there exist in Nature only four elementary kinds of matter (not counting the factors responsible for the way things happen) yet a variety of things can exist as a result of dissociation and recombination. This holds even if one posits only one elementary kind of matter, or an infinite number, out of which things are formed by combination and decompose by dissociation. Some people say that Anaxagoras too held that things are formed by such processes out of an infinite number of indestructible elementary constituents of matter.

59

Ibid. 976b19

Things can surely move even if there is no void. For example, Anaxagoras gave theoretical as well as experimental proofs for the statement that absolute emptiness does not exist. Yet he holds that things move even though there is no void.

60

Foundations of Scientific Thought (Metaphysica) 984a11

Anaxagoras of Clazomenae, who was older than Empedocles, but later in his activity, says that there are an infinite number of elementary constituents of matter. He says that the great majority of homogeneous substances,[1] like clear liquid and heat, are made and decomposed by processes of dissociation and recombination and in no other way. There are, however, some molecular species which never undergo change, but remain unaltered for all time.

61

Ibid. 984a19

. . . even if it is completely true that every object is ultimately made out of one, or more than one, elementary substance, the question still remains, "Why are they made at all, and what accounts for their formation?" Certainly matter does not change itself. Wood and bronze are not themselves responsible for the alterations which they undergo: wood does not make a bed, nor does bronze make a statue. Something else must account for change, and in looking for this something we are in effect on the track of the next key factor that can enter into a thing's explanation, the one we have called the factor responsible for motion and change.

The first people who engaged in scientific studies—the people who believed that there is only one elementary substance—were satisfied to go no further; although a few of them, as if stymied in an attempt to go on, said that the one elementary substance (which for them was all that really existed in the world) never undergoes *any* alteration. These thinkers did not simply assert that matter is never created or destroyed—something everyone has acknowledged from earliest times—but insisted that *no change at all* ever takes place, a position which they alone held. We see, then, that none of those who believed that the whole world is basically just one thing managed to come upon this next key factor—with the exception of Parmenides, after a fashion, in so far as he spoke of two factors, of a sort, rather than only one.

It was however relatively easy for those who had more than one elementary substance in their theories (for example, those who had a hot substance and a cold substance, like heat and dry dust) to use some as a source of motion and change. This is precisely what they did, for these thinkers gave heat substance the role of a substance which causes change, while they considered dry dust, clear liquid, and other such substances to be inert.

Since it was found that none of these men, either, with all their theories, could produce a satisfactory description of nature, people were compelled by the very nature of physical reality, as I have already said, to seek out this second factor. This was because it is simply not reasonable to assume (and I do not believe that these early thinkers did in fact assume) that heat substance, dry dust, or anything else resembling these substances is capable of arranging things in a suitable way, or keeping things suitably arranged; nor was it any better to assign such an important role to chance, that is, to spontaneous action.

It is clear, then, that the man who first said that Nature possesses a Mind just as animals do, thus accounting for the order of the universe and the order governing its parts, was like a sober man compared to the stammerers who preceded him.[1] We know with certainty that Anaxagoras said this, but Hermotimus of Clazomenae may well have stated it before him. Those who say this maintain that Mind, besides being the source of order in all things, is indispensable to an explanation of the behavior of all things, since it is the source of motion and change in the universe.

62

Ibid. 985a18

Anaxagoras uses Mind as a *deus ex machina* to account for the creation of the world. When he can not explain why something is necessarily as it is, he drags in Mind, but otherwise he will use anything rather than Mind to explain a particular phenomenon.

63

Ibid. 988a15

. . . Plato identified the source of perfection with one of the primary elements in his theory,[1] and the source of defect with the other,[2] a scheme toward which, as we see it, some of the earlier philosophers, like Empedocles and Anaxagoras, were also groping.

64

Ibid. 988a28

. . . Anaxagoras says that matter is composed of an infinite number of molecules of various substances.

65

Ibid. 988a33

. . . Other thinkers, however—for example, those who made Affinity and Repulsion, or Mind, or Love basic elements in their theories—included in their explanations of things something which originates motion and change.

66

Ibid. 988b8

. . . those who introduce Mind or Affinity into their explanations of things, speak of these entities as perfect. They do not however say that these entities are perfect final states toward which physical processes tend, but only that they originate motion and change.

67

Ibid. 989a30

As for Anaxagoras' theory, it would not be unreasonable to hold that it is based on two primary concepts; for though he himself did not say this explicitly, his statements clearly imply it.

Of course, it is absurd to say, as Anaxagoras did, that in the beginning all things in the universe were mixed. For to say that things were mixed implies that they were previously separate. Also, everything in this world can not be mixed together. Again, if everything could be mixed together then, since what is mixed can be separated, qualities could be separated from objects.[1]

Nevertheless, if someone were consistently to spell out what Anaxagoras wanted to say, he would doubtless find that Anaxagoras was quite an original thinker. Anaxagoras was clearly right in implying that no predicate could be applied to the mixture before anything had been separated out, as when he said, for example, that it could not have been any color like white, black, gray,[2] etc. but had to be colorless. For indeed it contained all colors. Similarly it was tasteless, and by the same token it had no other quality. Indeed, no specification of quality, quantity, or substance could be made concerning the mixture. If this were not so, it would have been specifiable in some way—which was impossible since it was a mixture of all things and nothing specific had yet been separated out.

Now Anaxagoras says that all things in the universe except Mind were mixed together, and that Mind alone was free from admixture and pure. It may be concluded then that he meant to say that the basic elements of his theory are two in number: one simple and free from admixture, and the other a completely different one which is analogous to undifferentiated matter in our theory, i.e., matter which has not yet been differentiated and is distinguished by no property.

These things are not stated explicitly or clearly. Still Anaxagoras' words imply views which resemble those of later thinkers, and are not even inconsistent with the most modern ones.

68

Ibid. 991a14

. . . it might seem that the reason a white object is white is that white particles are among its ingredients. This view, first proposed by Anaxagoras and later held by Eudoxus and others, is . . . easily overthrown. For it is easy to show that many absurdities follow from such an opinion.

69

Ibid. 1007b25

. . . The result is the state of affairs Anaxagoras speaks about: all things together. No specific proposition would be true.

70

Ibid. 1009a27

. . . Anaxagoras says that all things are in all things . . .

71

Ibid. 1009b25

. . . They say that Anaxagoras remarked to his friends that things are for each person as they appear to him to be.

72

Ibid. 1012a26

. . . Anaxagoras holds that the properties of any object lie between the extremes of contrasting qualities. Thus, for him, every proposition must be false.[1] For if you talk about mixtures, then the things you talk about can not have any particular specified property nor can they have the negative of any property,[2] so that no precise statement about such things can be true.

73

Ibid. 1056b23

'Many' as opposed to 'one'—rather than to 'a few'—can be applied to any number . . . In this sense even two is many . . . In its simple meaning, however, 'two' is a few, since of all numbers (greater than one) less than other numbers, two is the first.

Thus Anaxagoras should not have taken liberties[1] by saying "all things in the universe were together, infinitely many and infinitely small." Instead, he should have said "all things in the universe were together, exceedingly many and exceedingly[2] few," because then they would not have been infinite.[3] For 'a few' is two—not one, as some people maintain.

74

Ibid. 1063b24

According to the theories of Heraclitus and Anaxagoras no statement can be true, because if what they say holds, contradictory predicates would apply to the same object. Thus when Anaxagoras says that there is something of everything in all things he means that an object can not be entirely sweet or bitter; nor can it fully possess any one of a pair of contradictory qualities, since all things are in all things not merely potentially, but as real and distinct entities.

75

Ibid. 1069b19

. . . it is also possible that the final outcome of any process of change existed earlier potentially, though it did not exist actually. Anaxagoras' universal mass is a case in hand. But it would have been better had he said, "All things were always in the universe potentially, but were not always actually present," instead of simply referring to "All things together" . . . It is also not correct to talk about "All things together," since in Anaxagoras' theory the things differ from each other in the kind of matter they contain. But why should he have an infinite number of things and not one? Mind is one! So that if there were also only one kind of matter in the theory it could at any time become actually any of the things it was potentially.

76

Ibid. 1072a4

. . . Anaxagoras, however, affirms that the actual is prior to the potential, for Mind is actual.[1]

77

Ibid. 1075b8

. . . Anaxagoras too introduces something perfect as a primary concept in his theory, identifying it with the source of motion and change. He says that Mind originates motion and change. However, Mind initiates processes of physical change which approach some perfect final state. Therefore, in Anaxagoras' theory, perfection may be different from the source of motion and change,[1] except that in common speech we frequently equate a factor which brings about a perfect final state with the final state itself, as when we say that healing is, in a sense, health. Furthermore, it is illogical not to include in the theory a primary concept diametrically opposed to the perfection of Mind.

78

Ibid. 1079b20

[This passage is the same as source 68.]

79

Ibid. 1091b11

. . . among the more recent learned men, Empedocles and Anaxagoras, for example, say that the most perfect thing gives objects their properties: Empedocles introduces Affinity as one of the elementary constituents in his theory, and Anaxagoras introduces Mind as a primary concept in his.

80

Ethics [*Called after Nicomachus*] (*Ethica Nicomachea*) 1141b2

. . . It is clear from what has been said that wisdom consists in comprehending matters held rightly in the highest esteem, and meditating on them. Thus people say that Anaxagoras, Thales, and other such men were wise even though they were not practical; for it is quite obvious that none of these men knew what was good for himself. It is said that the things they knew were unusually strange and amazingly difficult, but divorced from practical everyday affairs and thus totally useless.

81

Ibid. 1179a13

It appears that Anaxagoras believed that no truly happy man would ever have riches or power, for he said he would not be surprised if a truly happy man seemed crazy to most people who judge by externals because they perceive nothing more.

82

Ethics [*Called after Eudemus*] *(Ethica Eudemia)* 1215b6

When Anaxagoras of Clazomenae was asked, "Who is most truly happy?" he answered, "No one *you* would think, but someone *you* would deem to be crazy." He gave this answer when he saw that the man he was talking to thought that to be happy one has to be tall, good-looking, and rich. Anaxagoras probably thought that only an upright man whose life is free of suffering, or else one who meditates on the most exalted things, can be called happy in the sense in which the term is applicable to human beings.

83

Ibid. 1216a11

They say that Anaxagoras was once asked . . ., "Why should anyone choose to be born rather than never to come into the world?" to which he replied, "For the sake of contemplating the universe and the order governing its parts." He believed that it is worth choosing life for the sake of one branch of knowledge alone.

84

Rhetoric (Rhetorica) 1398b15

Alcidamas says that . . . even though Anaxagoras was a foreigner the people of Lampsacus gave him a funeral, and still honor his memory.

85

On the Rising of the Nile[1] *(De Inundatione Nili)* fr. 248 (Rose), 1

Anaxagoras, the son of Hegesibulus of Clazomenae, says that the river Nile swells in the summer because of melting snows. This accounts for the river's rise as we have described it, except that the usual high water mark is far above what one would expect on the basis of this theory. This is because a great deal of snow yields only a little water, while the Nile inundates a large area, and its depth at flood-peak has been measured to reach more than thirty cubits. Consider, moreover, the following question: where might there be snow that could run off into the Nile? Ethiopia and Libya are uninhabitable precisely because they are too hot. As for Asia, the Nile does not originate there; for the Lake of Sytho is right next to the sea that borders on Syria, and the distance between it and the Red Sea is just a thousand stadia; and some say the Red Sea connects with the outer ocean. Thus it would not appear that the Nile originates in Asia, or even that it would be possible for it to originate there, since we do not know for sure whether the Red Sea is landlocked, or is connected to the sea which lies beyond the pillars of Hercules. Moreover King Artaxerxes Ochus was deceived in this matter. In the course of a war he was waging against Egypt, he attempted to divert the Indus, believing it to be the Nile; for he had heard that, like the Nile, it has crocodiles in it. But when he sent to the people called the Omphali, he learned that the river empties into the Red Sea, and so ceased from his attempt. Later however he became convinced that he had been right in attempting to divert *some* river, because the Indians told him of another river in that part of the country whose source is found on a mountain called Aletus, where the source of the Indus too is found. Whether or not they were telling the truth, they told him that this other river has crocodiles in it, and that it flows all the way around the Red Sea. The king would have tried to divert this river from its course, but they stopped him by sending to him and pointing out that if he diverted the river he would lay waste to a region far greater than the one he would gain by subduing Egypt. This was one story the king heard concerning the source of the Nile and its relation to the Red Sea. The other was the one given by Athenagoras, the son of Arimnestus, who told him that the Red Sea and the sea beyond the pillars of Hercules were one and the same sea. This story however was hardly convincing.

In any case if melting snows from Mount Aletus really were what caused the Nile to rise, the flooding would take place differently from the way it does; for it is said that the mountain is halfway between India and Ethiopia, which makes it a five-month's journey from each. Now, there is a noticeable difference between flood-crests that travel long and short distances. In the latter case the peak arrives first, and the waters then subside until the flood has entirely passed away. In the former case the advancing flood builds up to a peak. The same holds true for winds; this is the origin of the popular saying, "When the south wind rises and the north wind subsides . . ." The south wind reaches us from far away so that first it blows weakly, and then it increases in force with its last gust. The north wind however behaves just the other way round, since the inhabited regions of the earth lie in the north.

Now the Nile reaches its peak at the very beginning of the flood, and later the waters subside until the flood passes away entirely. Moreover, the flood is greater if it occurs at new moon, or when the moon is waning, than when the moon is waxing, or when it is full. On the hypothesis being discussed the opposite should be the case, since ice melts at full moon. Also the flood waters are in fact higher when north winds blow than when south winds blow, while ice melts more when the south wind blows than when the north wind does.

The same holds for the theory that the Nile originates near the Pillars of Hercules, the theory propounded by Promachus of Samos, who says that the snows melting on the Mountain of Silver give rise to the Nile and to the Chremetes River as well. Since he says that the Nile flows through all Libya, this would imply that its flood-crest travels far.

So much then for the reason Anaxagoras gave for the overflowing of the Nile.

THEOPHRASTUS

372/369–288/285 B.C.E.

86

On Plants (Historia Plantarum) 3.1.4

. . . It must be assumed that wild plants spring up . . . spontaneously as well. Indeed, even natural philosophers discuss this: Anaxagoras says that the air contains all the different kinds of seeds, and that these are swept down in rains and produce plants.[1]

87

On Sense Perception (De Sensu) 1

All the various theories of sense perception can be divided into two groups: one accounting for perception with a theory of similarity, the second with a theory of difference. Parmenides, Empedocles, and Plato belong to the former group, Anaxagoras and Heraclitus and their schools, to the latter. . . . The latter group assumed that sense perception necessarily involves qualitative change; and that only bodies with different properties can bring about physical changes in one another, since like objects do not affect each other. This, then, was their central point. In support of their theory they cited the sense of touch, since something which has the same temperature as the body does not feel either hot or cold.

88

Ibid. 17

. . . when we perceive, we often feel an irritation during the act of perception. Anaxagoras says we always do, since he holds that some irritation accompanies every act of perception.

89

Ibid. 27

Anaxagoras says that sense perception necessarily involves the interaction of bodies possessing different properties, since like objects do not affect each other. He tries to explain how each of the senses works.

Anaxagoras says that sight is due to the reflection of light incident on the pupil. An object however is not reflected in a mirror of its own color but rather in one of a different color. Now most animals have eyes whose color differs from the colors seen in the daytime; but some have eyes whose color differs from the color of night, and these therefore see well at night. In general, the eyes of most animals are the same color as night. Furthermore, reflection occurs during the day because light too is necessary for reflection. Anaxagoras also says that a bright[1] color is reflected more strongly in a dark mirror.[2]

He says that we feel and taste in the same way.[3] Thus, objects having the same temperature can neither heat nor cool one another when brought into contact, nor does sweet interact with sweet, or sour with sour; rather, cold is perceived by means of hotness, freshness by saltiness, and sweetness by sourness, according to the degree of contrast. Anaxagoras says that all things, possessing all these qualities, are actually present in each of us.

He accounts for the behavior of the senses of smell and hearing in a similar fashion. The mechanism of the former is inhalation, of the latter, sound reaching the brain; for the bone which surrounds the brain contains sinuses, to which the sound penetrates.

Anaxagoras says that some irritation accompanies every act of perception. (This seems to be a consequence of his basic hypothesis, since whenever something comes into contact with something unlike itself some pain is produced. This is clearly so when a stimulus is present over a long interval or is intense.) Anaxagoras comes to this conclusion because bright colors and excessively loud noises are irritating, and it is impossible to bear them very long.

Large animals perceive more, and in general perception increases with size. For example, animals with big, clear, shiny eyes can see large or distant objects while the opposite is true of animals with small eyes.[4] This holds for hearing, too. Large animals can hear great or distant noises, while smaller noises escape them; small animals, on the other hand, hear small noises and noises close by. So, too, for the sense of smell. The more rarefied the air the more strongly it smells, for when air is heated it becomes rarefied and smells. Now, a large animal draws in dense as well as rare air when it inhales, while a small animal draws in only rare air. Therefore large animals perceive in greater measure.[5] For smells are stronger at close quarters than when far away because when smells are nearby they are dense, but spread out they are weak. And one might say in general that large animals do not perceive rare smells or small animals dense ones.[6]

As has been said, it is not entirely unreasonable to account for sense-perception by the interaction of bodies having contrasting properties. Indeed, it seems to be true that qualitative changes do not occur when similar things interact, but only when unlike things do. However, there is no evidence that sense perception entails qualitative change at all, or that an object is in fact perceived by means of something unlike it. It is simply not true that every act of perception is accompanied by some irritation, nor does everyday experience indicate that it is. On the contrary, some acts of perception are pleasurable and most do not involve any irritation. In fact, the assumption that sensation is accompanied by some irritation is not even logical;

for sense perception is natural, and something natural can neither be abnormal nor accompanied by irritation, but must rather be pleasurable. Such indeed seems to be the case with sensation. For we enjoy most things most of the time, and pursue sensation not only as a means to attain particular things but also as an end in itself. Moreover pleasure and pain are always connected with sensation and every natural process always tends to the most perfect state. Therefore, sense perception, just like abstract thought, must be pleasant rather than unpleasant. In plain language, since thinking is not unpleasant, neither is perception, since they are similar in their functions and work in the same way.

Furthermore the effects produced by an intense or prolonged stimulus can not serve as evidence that sensation is accompanied by irritation. They can only show that the impression received somehow corresponds to the object perceived. This probably explains why some stimuli are too weak to be perceived while, on the other hand, excessively strong stimuli cause discomfort and damage. Thus Anaxagoras has deduced the normal state from abnormal states—in this case, from states of excessive sensory stimulation.

True, it is clear and generally acknowledged that irritation, just like gratification, is caused by some things at some times. But it is not logical to conclude that sensation causes irritation any more than it is to conclude that it causes gratification. The truth is probably that sensation is accompanied by neither, just as thought, which goes on continually, is accompanied by neither. For sense perception could not take place if it were accompanied by irritation or gratification. We see then that in this case Anaxagoras drew conclusions about perception in general on the basis of one small piece of evidence.

Again, of the statements that large animals perceive more, and that in general perception increases with the size of the sense organs, the first raises certain problems. For example, one might ask whether it is not true that small animals have greater perception than large ones; for it seems obvious that small animals are endowed with more acute perception which allows them to perceive small objects, and it would be reasonable to expect that an animal which can perceive smaller things can also discern larger ones. Moreover, it appears certain that some of the senses are sharper in small animals, so that with respect to these senses at least, large animals have poorer sense perception. On the other hand, since smaller animals seem to be unaware of certain strong stimuli—for example, certain loud noises and strong colors—it seems that sense perception is indeed more perfect in larger animals. At the same time, the sensory capacity of an animal should depend on the functioning of the entire organism. This immediately raises the problem which we have mentioned above, namely, whether Anaxagoras' formulation is at all correct; for perception does not vary according to size in members of the same species, which indicates that the most important factor is probably the functioning of the entire organism.

In regard to the second statement mentioned above, Anaxagoras seems to be very close to Empedocles in ascribing variations in perception to variations in size; for Empedocles says that sense perception occurs when the object sensed fits the pores of the sense organ. A particular difficulty arises for Anaxagoras in the case of smell: on the one hand he says that rare air has a more pronounced odor, and on the other that those animals which inhale dense rather than rare air have a sharper sense of smell.[7]

Anaxagoras' theory that sight is due to reflection is a common one. Indeed, most people assume that sight is due to the reflection of light in the eyes. What they have not taken into account is that the images we see are not the same size as the reflection in the pupil,[8] nor have they understood that objects having contrasting properties can not be reflected simultaneously. Furthermore, motion, distance, and magnitude can be seen, but are not reflected.[9] Again, there is no reflection in the eyes of some animals, for example, those with hard, dry eyes, or aquatic animals. On the other hand, on Anaxagoras' premises it would follow that even many non-living things would see, since there are reflections in water and in bronze and in many other things.[10]

He says that differently colored objects are reflected in one another, but that objects whose color is bright are reflected more completely in objects whose color is dark. Thus, according to him, black and, in general, dark eyes must see best, though light eyes see too. Therefore, the organ of sight being the color of night, he says that light[11] is responsible for the reflection which takes place in the eye.

In reply it may be said, first of all, that reflection is not the mechanism by which we see light itself. Then again, black objects do not receive more light than white objects.[12] Furthermore, we see elsewhere that there is stronger reflection from shiny, clear surfaces, as Anaxagoras himself acknowledges when he says that the membranes of the eye are thin and shiny. Finally, most people assume that sight involves fire, because fire is the major component of color.

Anaxagoras then, as we have said, presents here an old and widespread theory. His particular contribution is to treat each of the senses individually, especially sight, because that is the most important sense. On the other hand, he is not clear in his account of the more tactile senses.

90

Ibid. 38

Clidemus . . . does not say that Mind is responsible for all things, as Anaxagoras does.

91

Ibid. 59

Some physicists say that the properties which we perceive are heaviness and lightness, or hotness and cold. For example, they say that what is rare and thin is hot, and what is dense and thick is cold. Anaxagoras distinguishes between colorless gas and aether in the same way.[1]

92

Loc. cit.

. . . The other physicists say that only white and black are primary colors, and the rest of the colors are mixtures of these. For example, Anaxagoras uses only white and black in his theory.

93

On the Origin of Plants (De Causis Plantarum) 1.5.2

. . . if air emits seeds and wafts them down, as Anaxagoras says . . .[1]

THE INSCRIPTION ON THE PARIAN MARBLE (*MARMOR PARIUM*)

probably 264/3 B.C.E.

94

Entry for the Year 442/1 B.C.E.

179 years ago Euripides, at the age of forty-four, won his first prize for a tragedy. Diiphilus was then archon at Athens. Socrates and Anaxagoras also lived at the time of Euripides.

SATYRUS

fl. third century B.C.E.

95

Life of Euripides (Oxyrhynchus Papyrus 1176) fr. 37.1.24

[The name of Anaxagoras—multilated—appears in no discernible context.]

96

Ibid. fr. 37.3.15

Euripides' account of Anaxagoras' cosmology is completely accurate . . .[1]

LUCRETIUS

probably 94–55 B.C.E.

97

On Nature (De Rerum Natura) 1.830

Next let us investigate what the Greeks call the 'homoeomery of Anaxagoras.'[1] The poverty of our language prevents me from translating this word, but it is easy to explain what it means. First of all, when he speaks of a homoeomery, he evidently believes that bones are formed out of extremely small, minute pieces of bone; that flesh is formed out of extremely small, minute pieces of flesh; that blood is formed when many droplets of blood come together; that gold is composed of grains of gold, that earth is a collection of little pieces of earth, heat of little pieces of heat, water of little droplets of water; and he imagines that other things are formed in a similar manner. Further, he does not admit the existence of a void anywhere at all, or of a limit to the subdividing of bodies.

In these two views of his he seems to me to be just as wrong as the thinkers I have spoken of above. In addition, the elementary constituents of matter, as he conceives them, are not permanent enough to qualify as such. For if the elementary constituents of matter were endowed with the same properties as the things around us, they too would decay and decompose, and nothing would prevent them from passing away. For which of them would survive under high pressure, and which escape destruction in the teeth of death? Would heat? Clear liquid? Or colorless gas? Which would remain? Blood? Or bone? None of them, if you ask me. For everything, being composed of the same substance through and through, would be just as perishable as the things we see before our eyes, which all come to some violent end and pass away. But nothing can revert to nothingness or come to be out of nothingness, as I have already shown. Moreover, since living matter takes in food for growth and nourishment—and we are told that veins, blood, and bone, and all foods composed of various kinds of living matter (if they wish to include them), are made of and contain small particles of muscle, pieces of bone, and, in general, pieces of veins and drops of blood—they would have to conceive of *all* food, liquid as well as solid, as a composite mixture of foreign substances such as bone, muscle, blood, and clots. Again, if all the living things which grow out of earth are contained in earth, earth too must consist of the foreign substances which arise out of it. Consider anything else, and the same formula applies: If flame, smoke, and ash lie hidden in firewood, then firewood too must consist of foreign matter. Thus, anything which takes its nourishment from earth, must itself take in, in order to grow, the foreign substances which in turn emerge from firewood.

There remains a small loophole through which Anaxagoras can escape. This is his own assumption that all things are imperceptibly mixed in all things, and that each thing presents the appearance of the component in its particular mixture which predominates numerically and is most obviously visible. This however is far removed from the truth. For if it were true, wheat crushed by the overwhelming pressure of the millstone would often have to show some trace of blood, and indeed when we grind anything into which human flesh has gone,[2] blood should drip out from between the millstones. Similarly, grass and clear water should evidently often exude drops with the same sweet taste as drops of milk from a ewe's udder;[3] and when clods of earth are crushed, tiny pieces of different grasses, grains, and leaves should be seen to have been hidden, scattered throughout the clods; and finally tiny particles of ash, smoke, and fire should be revealed when firewood is chopped. Since we see from experience that nothing like this occurs, it is certain that things are not mixed in other things in this way.[4]

CICERO

106–43 B.C.E.

98

The Orator (De Oratore) 3.56

Others . . . like Pythagoras, Democritus, and Anaxagoras sought peace and quiet for the purpose of carrying out their unusual resolve to lead a life of contemplation. They retired completely from political affairs and devoted themselves to the observation and explanation of natural phenomena.

99

Ibid. 3.138

No screaming demagogue taught Pericles to rant at the water clock.[1] Rather they say that he was taught by the famous Anaxagoras of Clazomenae, a man most learned in profound matters.

100

Ibid. 1.44

. . . This is because of the obscurity which surrounds all things. This obscurity led Socrates, and before him Democritus, Anaxagoras, Empedocles, and almost all the ancients to profess ignorance; for they held that nothing can be learned, nothing perceived, and nothing known; that our perception is limited, our mind weak, and our life short; and, as Democritus said, that truth is buried in the depths, that everything is fettered by conjecture and convention, that there is no room left for truth, and finally, that all things are enveloped in darkness.

101

On Platonic Philosophy (Academica) 2.72

Anaxagoras said that snow is black. Would you put up with me if I said it? I think not, even if I offered it hesitantly. But who was

Anaxagoras that he could say such a thing? Certainly not a sophist! For only those who indulge in philosophy for the sake of ostentation or profit are called sophists. Anaxagoras' great fame, however, is due to his dignity and to his brilliance.

102

Ibid. 2.100

. . . and a truly wise man will find it easy to succeed where Anaxagoras failed, in showing that snow is white. For Anaxagoras did not only deny that snow is really white, but also said that it did not even appear to him to be white, because he knew for a fact that water is black and that snow is frozen water.

103

Ibid. 2.118

Anaxagoras speaks of an infinite mass of matter out of which arise minute particles which are similar to one another. In the beginning, these particles were mixed up together; later they were set in order by divine Mind.

104

Brutus 44

. . . At just about the same time Pericles the son of Xanthippus, of whom I have spoken above, used the principles of rhetoric for the first time. Although there was no course in rhetoric in his day, yet he easily applied to public law and to politics the training he had received from Anaxagoras the physicist in recondite, abstruse subjects.

105

Discussions at Tusculum (Disputationes Tusculanae) 1.104

Anaxagoras gave a splendid reply to his friends as he lay dying at Lampsacus. Asked by his friends whether he wished to be returned to his native Clazomenae if anything happened to him, he answered: "It is not at all necessary; the path to the underworld is the same from any place."

106

Ibid. 3.29

If you reflect upon calamities to come, it makes them easier to bear when they arrive, since you have been prepared for them far in advance. This is why the words of Theseus in Euripides[1] are admired. Allow me to translate them into Latin, as I often do: "For I remembered I had heard this from a learned man./ Accordingly I dwelled on miseries to come—/ on bitter death, or exile's mournful flight;/ always reflecting upon some weighty woe,/ so that if cruel fate should chance to strike me down/ the pangs of sudden grief will not take me unawares."

When Theseus says that he heard it from a learned man, Euripides himself is talking; for he had been a pupil of Anaxagoras, who is reported to have said when his son's death was announced to him: "I knew he was mortal when I begot him." The point of this story is that calamities cause grief only to those who have not given them any thought.

107

Ibid. 5.115

Otherwise would Anaxagoras, or Democritus, whom we are discussing, have abandoned their fields and their inheritance to dedicate themselves wholeheartedly to these divine delights of study and the search for truth?

108

Concerning the Gods (De Natura Deorum) 1.26

Next is Anaxagoras, the student of Anaximenes. He was the first to say that individuality and proper measure were assigned and given to all things by the power and intellect of infinite Mind. In saying this, Anaxagoras did not realize that there is no such thing as motion brought about by direct physical contact with an infinite source of motion,[1] or that perception would be entirely out of the question in his theory unless nature as a whole perceived every stimulus.[2] Further, if he meant to say that Mind is itself, as it were, a living being, it would have to have something within it which qualified it to be called a living being.[3] But what can lie within Mind? Is it then to be bounded by an external body?[4] This, too, is surely unacceptable. It seems therefore that plain, simple Mind, with nothing added to it by which it can perceive,[5] is beyond the power of the mind to conceive.

VARRO

116–27 B.C.E.

109

Handbook of Farming (Res Rusticae) 1.40.1

Seeds, from which everything is generated and grows, are of two kinds: one imperceptible, the other perceptible. There exist imperceptible seeds if, as Anaxagoras the physicist said, there are seeds in the air, and the rain which falls on the fields carries them down, as Theophrastus writes.[1]

PHILODEMUS

c. 110–*c.* 40/35 B.C.E.

110

Rhetoric[1] (*Volumina Rhetorica*) fr. 3, 2.169 Sudhaus

. . . for one would not agree with Anaxagoras that it follows that all is in all . . .

111

Ibid. fr. 7, 2.180 Sudhaus

. . . one of the slaves of . . .[1] who had been whipped brought a charge against Anaxagoras before the citizen jurors . . .[2]

112

Ibid. col. 21, 2.226 Sudhaus

Pericles, then,—who he[1] said was the easiest to put up with among the rhetoricians—was a pupil of Anaxagoras and of other philosophers, and perhaps even came to equal them . . .

113

Ibid. fr. 7, 2.229 Sudhaus

[All that can be elicited from this fragment is the fact that Anaxagoras' name appears in proximity to Pericles'.]

114

Against [the Sophists] (Adversus [Sophistas]) fr. 10.3 Sbordone

. . . when he[1] was detained on Teos he used to engage in sophistical arguments with the man[2] who read the works of Anaxagoras and Empedocles and loved to split hairs about them.

DIODORUS OF SICILY

fl. *c.* 60–30 B.C.E.

115

World History (Bibliotheca Historica) 1.6.3

Those who think that the world was created[1] and may be destroyed also say that the human race, like the world, first appeared a finite number of years ago. They say that the original state of things was such that sky[2] and earth were one, since they were mixed together.

Later distinct objects were formed, and the world took on the order which can be seen in it. Air began to move unceasingly and the burning hot part of the air collected at the very highest altitudes (since it is the kind of thing which always rises because of its lightness). As a result the sun and the whole multitude of heavenly bodies were caught up in the universal vortex. At the same time, slime and mud, with water mixed in them, collected in one place, being heavy. By their continual internal agitations and condensations the sea was created out of the water in them, and the earth—muddy and soft throughout—out of their more solid components. The earth in turn hardened as the blazing sun shone upon it, when, due to the heat, its surface rose like fermenting dough. Pockets of water formed in many places creating foul spots covered by thin films—a process which still can be seen when swamps and marshes dry up all of a sudden, provided the air is very hot and has become hot rapidly. Due also to the heat mentioned above, the water became pregnant with living things; it was nourished at night from the mist falling from the surroundings, and was congealed during the day by the heat of the sun. Finally when the pregnant waters reached the term of their development the films were burned through; they broke open, and all the different kinds of animals were produced. Those who had received the greatest amount of heat became birds and rose to high altitudes; those whose constitutions included earthy substances became reptiles and other terrestrial animals; and those who derived mostly from liquid collected in the part of space whose properties they shared, and are called water animals. The earth, however, was continually being hardened by the blazing sun and the winds, and so finally was no longer able to produce any of the larger animals. Instead, animals now reproduce by sexual intercourse with one another.

It seems that Euripides agrees with this view of the physical universe, having studied with Anaxagoras the physicist. For in the *Melanippe*[3] he says, "That sky and earth were once one/ and when they were separated they gave birth to all things and brought them forth:/ trees, birds, beasts, creatures that live in the sea,/ and the race of men."[4]

116

Ibid. 1.38.4

The physicist Anaxagoras said that the snow which melts in Ethiopia causes the rising of the Nile. The poet Euripides, who was his pupil, concurs in this opinion . . .

117

Ibid. 1.39.1

Democritus of Abdera says that snow does not fall in the south, as Euripides and Anaxagoras maintain, but rather in the north . . .

118

Ibid. 12.39.2

The machinations of Pericles' enemies are being described.

. . . In addition, they brought a false charge against Anaxagoras, the sophist who was Pericles' teacher, accusing him of disrespect toward the gods; and they implicated Pericles as well in the slanderous indictment . . .

DIONYSIUS OF HALICARNASSUS

fl. 30–8 B.C.E.

119

Rhetoric (Ars Rhetorica) Chapter 8.10

Euripides was a pupil of Anaxagoras, the man who said "all things together." Afterwards he became a pupil of Socrates and received better instruction, although it seems to me that he still thought Anaxagoras' teaching worth repeating in his plays; for he introduced the saying "all things are together" into *The Wise Melanippe.*[1] He hints at his kindly feeling for his former teacher at the beginning of the play, where Melanippe says: "The story is not my own—I learned it from my mother."

120

Ibid. Chapter 9.11

Euripides took lessons from Anaxagoras, the man who taught that all things were in all things and that later they became distinct. Afterwards he studied with Socrates as well and broadened his education. Still, he acknowledges his old teacher in the words spoken by Melanippe:[1] "The story is not my own—I learned it from my mother/ that sky and earth were once one."

STRABO

c. 64/63 B.C.E.–21 C.E.

121

Geography (Geographica) 14.1.36

The physicist Anaxagoras was a famous son of Clazomenae. He was a pupil of Anaximenes of Miletus, and the physicist Archelaus as well as the poet Euripides were his disciples.

VITRUVIUS

time of Augustus

122

On Architecture (De Architectura) 7. preface 2

If the ancients had not left us records, we would not have known what deeds were done at Troy, or what physical theories were propounded by Thales, Democritus, Anaxagoras, Xenophanes, and the rest of the physicists . . .

123

Ibid. 7. preface 11

. . . Agatharchus, who was the first to make a stage-set for a tragedy—one by Aeschylus given at Athens—left a treatise on the subject. Having studied this treatise, Democritus and Anaxagoras wrote on the same topic. They explained that if a point representing the pupil of the eye is marked off as a center from which rays extend radially outward, there then results in a natural way a correspondence to real shapes.[1] In this way, the images drawn would not be formless, but would represent accurately the forms of buildings on the scenery on the stage; so that some objects painted on the vertical plane surfaces would seem to lie behind, and some in front.

124

Ibid. 8. preface 1

Thales of Miletus, one of the Seven Wise Men, asserted that the basic constituent of all things is clear liquid; Heraclitus that it is heat. The priests of the Magi held that the basic constituents of all things are clear liquid and heat. Anaxagoras' pupil, Euripides, whom the Athenians called 'the philosopher playwright,' said that they are colorless gas and dry dust, adding that the earth, inseminated by rains from the sky, became pregnant and gave birth to human young and to the young of all the animals in the world, and that everything brought forth out of the earth returns to the earth when it decays in time's inexorable flow, while all things born out of the air return to the celestial regions where they do not pass away into nothingness but rather decompose and revert to their earlier state.[1]

125

Ibid. 9.6.3

Thales of Miletus, Anaxagoras of Clazomenae, Pythagoras of Samos, Xenophanes of Colophon, and Democritus of Abdera left elaborate physical theories which attempt to explain what things determine the behavior of the physical world and how each thing produces its effects.

PHILO

c. 30 B.C.E.–45 C.E.

126

On the Philosophical Life (De Vita Contemplativa) 2

All Greece sings the praises of Anaxagoras and Democritus, telling how they were so inflamed with a passion for philosophy that they allowed their holdings to become pasture for sheep. I, too, admire these men who rose above money, but . . .

127

On the Indestructibility of the World (De Incorruptibilitate Mundi) 2

Cosmos is used in another sense to mean the sky. For example, when someone asked Anaxagoras why he so often made his life miserable by spending the whole night out of doors, he looked up at the sky and said, "To look at the *cosmos*," by which he meant the turnings and revolutions of the stars.

128

On Providence (De Providentia) 1.22

Anaxagoras of Clazomenae says that a homoeomery[1] existed before the world was formed.

129

Ibid. 2.12

Anaxagoras, who inherited extensive possessions, is said to have disdained them utterly because of his love of virtue, the most beautiful possession of all. They say that he put aside all kinds of mindless things, even allowing cattle to graze freely at will in his wide-open fields, with the result that he maintained the herd in heroic style, even though he was ignorant of animal husbandry.

VALERIUS MAXIMUS

fl. during the reign of Tiberius

130

Famous Deeds and Sayings (*Facta et Dicta Memorabilia*) 5.10. *ext.* 3

Anaxagoras' saying must also be cited. When he heard of the death of his son he said, "The news you bring me is neither unexpected nor unusual; I knew that he whom I begot was mortal." These are words of virtue, words imbued with the most useful moral precepts. Whoever heeds them and takes them to heart will always be careful to remember, when he has children, that at the moment a child is born, nature decrees that it must one day return the breath it has received. Indeed a father must know that just as no one dies who has not lived, so certainly no one lives who will not die.

131

Ibid. 7.2 *ext.* 12

No less wise is Anaxagoras' reply to the man who asked, "Who is truly happy?" He said: "Certainly no one you think happy. Indeed you will find him among those you believe to be wretched. He will not be exceedingly rich or greatly honored, but one who faithfully and persistently cultivates learning for its own sake, or tends his own small plot of land, happy in retirement rather than in the public eye."[1]

132

Ibid. 8.7 *ext.* 6

How great was the burning zeal which must have consumed Anaxagoras! When he returned to his native land after a long stay abroad and saw his possessions deserted he said, "I would not be secure if these had not been destroyed." The wisdom of the saying is enviable. Indeed had Anaxagoras spent his time cultivating his land instead of his talent he would have stayed at home managing his ancestral possessions, and would not have been able to come back to them as the great Anaxagoras he was!

133

Ibid. 8.9 *ext.* 2

Pericles possessed the most felicitous gifts Nature can bestow, and worked assiduously under his teacher Anaxagoras to bring them to perfection.[1]

134

Ibid. 8.11 *ext.* 1

Once when Athens was suddenly and unexpectedly shrouded in darkness by an eclipse of the sun the whole city was terribly worried, and people believed that their destruction was being foretold from on high. Then Pericles came out before the people and related what he had learned from his teacher Anaxagoras concerning the courses of the sun and the moon; and he did not permit his fellow citizens to be panicked any longer by empty fear.

SENECA

c. 5–65 C.E.

135

Problems in Natural Philosophy (Naturales Quaestiones) 2.12.3

. . . Anaxagoras said that the fire in the clouds[1] trickles down from the aether. He held that quite a bit falls from the great quantities of fire in the heavens, and that the clouds catch this fire and keep it trapped for a long time.

136

Ibid. 4.2.17

Anaxagoras said that melting snow from the mountain peaks of Ethiopia flows down to the Nile. All antiquity was of the same opinion; this theory was also given by Aeschylus, Sophocles, and Euripides.

137

Ibid. 4.3.4

Why shouldn't I be free to hold the bold opinion Anaxagoras held? Scientists, more than anyone else, ought to be equally free to speak their minds: Hail is nothing else than ice, formed at high altitudes, and snow is just frost up in the air.

138

Ibid. 6.9.1

Anaxagoras is the leading exponent of the theory that earthquakes are caused by fire. He thinks the earth is rent by a force similar to that which rends air. The same force which rends clouds above the earth acts beneath the earth: a stream of hot air cuts through the thick air condensed into clouds beneath the earth, and fire flashes out from between the colliding clouds—that is, from the jet of air ejected during the collision. This fire, seeking to rise but finding its path blocked, pushes aside all obstacles until it either finds a narrow opening to the heavens or else forces one itself.

139

Ibid. 7.5.3

Charmander too, in his book on comets,[1] says that a huge, unusual light in the heavens, of the size of a large beam, which shone for many days, was seen by Anaxagoras.

PLINY THE ELDER

23/4–79 C.E.

140

Encyclopedia of Nature (Historia Naturalis) 1

The following is the entry from the Table of Contents of the Encyclopedia for Book II, Chapter 59, which appears as the next source.

Chapter 59. On Stones Which Fall from the Sky. Concerning Anaxagoras in this Connection.

141

Ibid. 2.149

Everybody in Greece knows the story of how in the second year of the seventy-eighth Olympiad[1] Anaxagoras of Clazomenae was able, through his knowledge of astronomy, to predict exactly when a stone would fall from the sun. The story goes that the fall occurred in broad daylight, not far from Aegospotami in Thrace, and that at the same time a comet was blazing in the night sky. The stone is still displayed today; it is as big as a wagon, and has a burnt color.

Anyone gullible enough to believe that this prediction was actually made, must admit that the fact that Anaxagoras had the ability to make such predictions is even more remarkable than the prediction itself, and that science must be discarded and all things jumbled together if we are to believe that the sun is a stone, or that there was ever any stone in it.

Nevertheless, there can be no doubt that stones do often fall from the sky. A stone is held in veneration for this reason even today in the public gymnasium at Abydus; it is not large, and its fall too is said to have been predicted by Anaxagoras . . .

JOSEPHUS

37/8–*c.* end of first century C.E.

142

Reply to Apion's Attack on the Jews (Contra Apionem) 2.166

Moses taught all of us to look to God as the source of all good, of the blessings all men share as well as of the special benefits granted us in answer to our prayers in times of tribulation. And he taught that no deed or unuttered thought can possibly escape God's notice. For he asserted that God is one, uncreated, eternally unchanging, surpassing any human conception of perfection, revealed to man through His power, but unknowable to man in His nature and identity.

This is not the place to speak of the fact that the wisest men of the Greeks learned to conceive of God in this way according to these basic concepts set forth by Moses. Suffice it to say that they have borne abundant witness to the fact that these attributes are perfect, and appropriate to God's majesty. For Pythagoras, Anaxagoras, Plato, the Stoic philosophers after him, and indeed almost all the philosophers seem to have had this conception of God.

143

Ibid. 2.265

Anaxagoras came from Clazomenae. Later when he maintained that the sun is a red-hot mass of ore, the Athenians, who believed it is a god, missed condemning him to death by a few votes.

DIO CHRYSOSTOM

c. 40–after 112 C.E.

144

The Corinthian Speech (Oratio Corinthiaca) Or. 37.37

I shall now speak of my statue and apply to it the saying of Anaxagoras. When he lost his son Anaxagoras said, "I knew he was mortal, having begot him." I can say that I did *not* know the statue was mortal; for statues are set up to be eternal . . .

QUINTILIAN

35/40–*c.* end of first century

145

A Textbook of Rhetoric (Institutio Oratoria) 12.2.22

. . . It is well known that Pericles . . . was a student of the physicist Anaxagoras . . .

PROBUS

late first century C.E.

146

Commentary on Vergil's Bucolics (Commentarius in Vergilii Bucolica) On 6.31

To the four basic constituents of matter Anaxagoras added Spirit, God, or Mind, the governing power by which they are controlled.

This Anaxagoras came from Abdera[1] and was a companion and disciple of Democritus, although some say that Dionysius of Smyrna was his teacher, and some that Aristotle was. He was a nobleman, a friend of Alexander, and a Persian count. He considered sense perception more important than anything else. Plato cites him in his volume on the soul in the following passage:[2] "Once, however, I heard someone reading aloud from a book it seems was by Anaxagoras, that Mind is that which always arranges and fashions everything. I rejoiced at hearing this account. It seemed to be a fine thing that Mind fashions everything. I thought that, if this was so, Mind must arrange all things in the best way and put together[3] each thing for the best."

Vergil himself holds the same opinion. He says:[4] "A spirit within sustains the entire bulk and a mind diffused throughout its members gives it motion." What Anaxagoras terms 'Mind'[5] he calls 'spirit.'[6]

147

Loc. cit.

As for the Homeric phrase, "the untiring sun," some people take it to mean fire, since they think the sun is just light mixed with fire. This view, also held by Anaxagoras of Clazomenae, was attacked by Socrates, as Xenophon tells us in the fourth book of the *Reminiscences of Socrates*.[1]

CLEMENT OF ROME

fl. *c.* 96 C.E.

148

A Tale of Chance Encounters (Recognitiones) 8.15

The Greek philosophers who tried to discover the basic constituents of the physical world came up with many different answers. Thus Pythagoras said that the basic constituents consist of numbers . . . Anaxagoras that they consist of subdivisions which are all alike.

PLUTARCH

c. 46–after 120 C.E.

149

How to Measure Your Progress towards Excellence (Quomodo Quis Suos in Virtute Sentiat Profectus) 15

We know that we have made even greater progress towards excellence when we not only admire good men when they are well-off, but also when—as lovers adore lisping and blanching in young people, and as the wretched tears of Panthea, mourning her wrong, aroused Araspes' love—we do not shrink in fear from an exiled Aristides, or an imprisoned Anaxagoras, or an impoverished Socrates, or a condemned Phocion, but we realize instead that virtue even in the company of misfortune is worthy of our love, and we welcome it even then . . .

150

On Luck (De Fortuna) 3

"For we are not perfect experts in boxing or wrestling,/ nor are we swift runners"[1] but we are inferior to animals in all these pursuits. However, using our experience, memory, wisdom, and technical skill, as Anaxagoras said,[2] we rob animals of their honey, steal their milk, and plunder all they have. With us then nothing occurs by chance, everything by forethought.

151

A Consolatory Essay to Apollonius (Consolatio ad Apollonium) 33

We must also look for guidance to those who bore the death of their sons with nobility, greatness, and calm—to Anaxagoras of Clazomenae, Demosthenes of Athens, Dio of Syracuse, King Antigonus, and many others both ancient and modern. We know, for example, the story they tell of Anaxagoras, who was teaching his students physics when he was told, by one of those who brought him the news, that his son had died. He interrupted the discussion briefly and said, "I knew the son I begot was mortal."

152

On Isis and Osiris (De Iside et Osiride) 48

Everyone knows how the Greeks deal with this question: according to them the domain of good belongs to Olympian Zeus and the domain of evil belongs to Hades. They also tell in their myths that Harmony is the child of sweet, fertile Aphrodite, and rough, pugnacious Ares. It is evident that the philosophers agree: . . . Anaxagoras calls good and evil 'Mind' and 'the Infinite,' respectively.

153

On the 'E' at Delphi (De E Apud Delphos) 15

I am afraid that if we come to the heart of the issue, it will embarrass our beloved Plato, just as he says that Anaxagoras was embarrassed by the word for moon. For does he not say in the *Cratylus*[1] that Anaxagoras pretended that an extremely ancient theory of the origin of the moon's light was his own original discovery?

154

On Restraining Anger (De Cohibenda Ira) 16

However, as Panaetius said, we should make use of Anaxagoras' remark at the death of his son—"I knew that I begot a mortal"—and exclaim at every annoying mishap: "I knew that I did not buy a wise slave"; "I knew that this friend of mine could get excited"; "I knew that my wife is a woman."

155

On Peace of Mind (De Tranquillitate Animi) 16

For we should not only admire Anaxagoras' disposition, which led him to exclaim at the death of his son, "I knew that I had begotten a mortal," but we should also emulate him and say at each vicissitude of fortune, "I knew that my wealth was ephemeral and insecure" . . .

156

On Brotherly Love (De Fraterno Amore) 2

. . . Nature made the hands the most coordinated and skilful of all organs by dividing them into fingers of unequal length. Thus, the ancient thinker Anaxagoras was led to ascribe human wisdom and understanding to the hands.

157

On Exile (De Exilio) 17

A happy man will be happy wherever he is, just as a wise or a virtuous man remains wise or virtuous anywhere at all. For example, Anaxagoras, while he was in prison, found a way to construct a square whose area is equal to that of a given circle.[1]

158

Questions Posed at a Dinner Party (Quaestiones Conviviales) 8.3.3

"Now . . . let me bring up Anaxagoras, who says that the sun gives the air an agitated, vibratory motion, as can be seen from the small pieces of dust or particles of matter—some people call them 'motes'—which are always darting back and forth in beams of light. He says that these cause a sputtering noise which increases with heat, and that they emit unpleasant sounds during the day, while at night their motion and noise ceases."[1]

When I had finished, Ammonius said, "It may seem silly for us to think we can refute Democritus and corroborate the view of Anaxagoras. But we can, provided we leave the sputtering noise of the particles out of Anaxagoras' theory; for it is neither likely nor necessary. Rather, the agitated motion of the particles moving about in the light suffices to scatter the sound over and over, since the air itself is the material medium of sound, as we have said. When the air is still, it transmits easily, smoothly, and continuously all the different components and motions of sound even from far off. For calm, windless air facilitates the transmission of sound, while wind scatters sound, as Simonides says: 'For there arose at that time no leaf-shaking breath of wind/ to scatter sweet speech and keep it/ from mortal ears.'[2] Indeed air vibrations often keep articulate and coherent sound patterns from reaching our ears, and they always lessen the intensity and magnitude of the original sound. At night there is nothing to impart motion to the air, but during the day there is the powerful agency of the sun, as Anaxagoras himself said."

159

That It Is the Duty of a Philosopher to Converse Most of All with People of High Station (Maxime Cum Principibus Viris Philosopho Esse Disserendum) 1

If a philosopher can get the ear of an active politician who is in office and fill it with an appreciation of ethics and beauty, he can benefit many people through his contact with but one man, as Anaxagoras did through his companionship with Pericles, Plato, through his friendship with Dio, and Pythagoras, through his with the rulers of the Italian states.

160

On Avoiding Loans (De Vitando Aere Alieno) 8

Anaxagoras allowed sheep to graze freely on his lands.

161

A Handbook of the Theories of Great Thinkers[1] *(De Placitis Philosophorum)* 1.3

Anaxagoras of Clazomenae declared that homoeomeries are the basic components of all things. It seemed to him virtually impossible for something to come out of nothing or to pass away into nothingness. Now, we take in plain, simple food, like the bread of Demeter, and we drink water; and from this food hair, veins, arteries, muscles, bones, and the other parts of the body are nourished. Since the tissues of the body grow in this way it must be granted that all existing things are in the food we take in; that they all grow by the addition of already existing things; and that in food there are particles which form blood, muscle, bone, etc. The existence of these particles must be deduced theoretically. For we must assume that there are some things whose existence can not be verified by direct perception. Thus, since bread and water furnish the tissues of the body, they must contain in them particles whose existence can only be deduced theoretically.

Because the particles in food are similar to the tissues which grow from them he called them 'homoeomeries,' and asserted that they are the basic constituents of existing things. He believed that the homoeomeries are the elementary kinds of matter while Mind is the factor which fashions things and sets all things in order. He opens like this: All things were together. Then Mind separated them and set them in order. (By *chremata*[2] he means 'things.') He should, then, be praised for having introduced a master craftsman in addition to matter.

162

Ibid. 1.7

What is the nature of God? . . . Anaxagoras says that in the beginning all matter was at rest, and the Mind of God set it in order and fashioned all things out of it . . . Both Anaxagoras and Plato are wrong to have involved God in human affairs, and to have said that He fashioned the world for the sake of man.

163

Ibid. 1.17

Concerning compounds and solutions, the ancients say that when a compound is formed out of the elementary kinds of matter a qualitative change takes place. Anaxagoras and Democritus and their schools say that it is when the elementary types of matter are juxtaposed that a compound is formed.

164

Ibid. 1.29

Anaxagoras and the Stoics say that chance is a factor human reason can not grasp: some things occur because they must, some are fated, some result from deliberate acts, some result from chance, and yet others occur entirely of themselves.

165

Ibid. 2.8

What is the reason the world is inclined to the plane of the ecliptic?[1] Diogenes and Anaxagoras say that after the world had been put together, and animals had already emerged from the earth, the world somehow inclined all by itself toward its southern part. Perhaps this was a result of Providence, working to the end that some parts of the world might be uninhabited and others inhabited, according to whether the climate is cold, hot, or temperate.

166

Ibid. 2.13

What are the heavenly bodies—the planets and fixed stars—made of? . . . Anaxagoras says that the surrounding aether is a burning hot substance whose intense whirling motion snatched up stones from the earth, set them on fire, and turned them into stars.

167

Ibid. 2.16

Concerning the courses and motions of the heavenly bodies, Anaxagoras, Democritus, and Cleanthes say that all the heavenly bodies move from east to west.

168

Ibid. 2.20

Concerning the composition of the sun . . . Anaxagoras, Democritus, and Metrodorus say that the sun is a red-hot mass of ore or of stone.

169

Ibid. 2.21

Concerning the size of the sun . . . Anaxagoras says that it is many times the size of the Peloponnesus.

170

Ibid. 2.23

Concerning the turning-points in the course of the sun . . . Anaxagoras says that they result from the pressure of the air in the north, which the sun compresses and endows thereby with a resistance which increases with density.

171

Ibid. 2.25

Concerning the composition of the moon . . . Anaxagoras and Democritus say that it is a fiery solid body with plains, mountains, and gullies on it.

172

Ibid. 2.30

Concerning the reflection of light from the moon and the reason the moon seems to be composed of earthy matter . . . Anaxagoras says the reason is the unevenness of its composition since it contains cold and earth, that is, because there is murky substance mixed in it along with its fiery matter. This is the reason that this heavenly body is called 'the body which shines with false light.'

173

Ibid. 3.1

Concerning the Milky Way . . . Anaxagoras says that the earth's shadow is cast upon this part of the sky when the sun is under the earth and so does not illuminate the entire sky.

174

Ibid. 3.2

Concerning comets, shooting stars, and meteors . . . Anaxagoras and Democritus say that a comet is a conjunction of two or more stars[1] whose rays meet . . . Anaxagoras says that the so-called shooting stars are carried down from the aether like sparks; this also explains why they are immediately extinguished.

175

Ibid. 3.3

Concerning thunder, lightning, thunderbolts, hurricanes attended with lightning, and typhoons . . . Anaxagoras says that these phenomena occur when heat falls into the cold below, i.e. when a part of the aether falls into the atmosphere. Thunder is produced by the noise, lightning by the contrast between the color of the aether and the black of the clouds, thunderbolts by a large quantity of light. Typhoons are produced by heat substance composed of yet more particles, and hurricanes attended with lightning are produced by heat substance mixed with clouds.

176

Ibid. 3.5

Concerning the rainbow . . . Anaxagoras says it is the reflection of the sun's light from a dense cloud, and that it always appears directly opposite the sun, which is the heavenly body that provides the light for the reflection. The so-called mock suns which occur along the shore of the Black Sea are accounted for in a very similar way.

177

Ibid. 3.15

Concerning earthquakes . . . Anaxagoras says that they occur when air slips under the earth's thick crust, first falling into the crust, and then shaking its surroundings when it can not find a way out.

178

Ibid. 3.16

Concerning the origin of the sea and why it is bitter . . . Anaxagoras says that the water in the marsh which initially covered the earth was heated by the sun during its daily circuits. Thereupon the stagnant waters were evaporated and the rest remained salty and bitter.

179

Ibid. 4.1

Concerning the rising of the Nile . . . Anaxagoras says the Nile rises because of the snow in Ethiopia which melts in the summer and remains frozen in the winter.

180

Ibid. 4.3

Is life material and, if so, what is it made of? . . . Anaxagoras' followers say that it is a gaseous substance. Thus they too hold that it is material.

181

Ibid. 4.19

Concerning sound . . . Anaxagoras says that sound is produced when breath falls on the air, which is elastic and carries the impulse to the ear by repeated transmission. This also is the way so-called echoes are produced.

182

Ibid. 5.7

How are male and female progeny formed? . . . Anaxagoras and Parmenides say that when the ejaculation from the right testis falls into the right side of the womb males are formed, and similarly for the left. If however the paths are crossed a female results.

183

Ibid. 5.19

. . . how were animals created and will they ever disappear? . . . Epicurus and his school, according to whom the world is uncreated, say that animals reproduce from one another, for they too are part of the world.[1] Anaxagoras and Euripides concur. Euripides writes: "Nothing which comes to be dies, but one thing divides into others and exhibits different shapes."[2]

184

Ibid. 5.20

How many species of animals are there, and do they all possess sensation and the power of expressing themselves in a coordinated manner? Anaxagoras says that all animals have the ability to express themselves in action, but that they do not all possess the power of expression typified by mind and evinced in passive pursuits, the so-called 'ability to communicate thought.'

185

Ibid. 5.25

Do sleep and death belong to the soul or to the body? . . . Anaxagoras says that sleep ensues when the activity of the body lags. Accordingly sleep involves the body and not the soul. Death also involves the soul: it is the sundering of the soul from the body.

186

Ibid. 5.27

Concerning nourishment and growth . . . Anaxagoras says . . . are nourished, on the one hand . . .[1]

187

Explanation of Natural Phenomena (Aetia Physica) 1

Why don't plants thrive on sea-water? Can it be for the same reason that land animals do not? Indeed, Plato, Anaxagoras, Democritus, and their schools think that a plant is an animal rooted in the earth.

188

On the Man in the Moon (De Facie in Orbe Lunae) 16

A favorable reception was given to our friend's exposition, which presented the Anaxagorean theory that the sun gives the moon its light.

189

Ibid. 19

I think . . . that Anaxagoras said that the moon is as large as the Peloponnesus.

190

On the Emergence of the Soul in Plato's TIMAEUS *(De Animae Procreatione in* TIMAEO*)* 1026b

. . . It is the sum total of all the activity in the universe proceeding in a rational manner; it is harmony and reason exerting that irresistible force tempered with persuasion, which most people call Fate; Empedocles calls it Affinity and Repulsion; Heraclitus calls it the harmony of the cosmos vibrating like a lyre-string or a bow-string; Parmenides calls it Light and Darkness; Anaxagoras calls it Mind and Infinity; Zoroaster calls it God and the devil . . .

191

Themistocles 2.3

. . . Stesimbrotus says that Themistocles was a pupil of Anaxagoras and studied with the physicist Melissus, but his dating is wrong; for Pericles, who was much younger than Themistocles, opposed Melissus in the siege of Samos and was a companion of Anaxagoras.

192

Pericles 4.4

However Pericles' most frequent companion, the man who most of all was responsible for his elevated style and dignity of mind—which lifted him above demagoguery—and in general for the lofty and exalted reputation he gained for good character, was Anaxagoras of Clazomenae, who was called 'Mind' by his contemporaries. Perhaps he received this nickname because he was admired for his obviously wide and extraordinary understanding of physics, or perhaps because he was the first to say that Mind, rather than chance or blind determinism, is primarily responsible for arranging all things. Mind alone is pure and free from admixture while all other things are composite; and it separates the homoeomeries from each other.

Pericles admired this man intensely, and eagerly mastered the results of Anaxagoras' so-called star-gazing. This enabled him to keep a serious mind and to maintain a high style free from vulgar, mean coarseness; his face rarely relaxed its composure to break into laughter; his walk was dignified, his clothes never became disheveled because of passionate outbursts in his speeches, and the tone of his voice always maintained an even level. All these qualities aroused universal admiration. Once when he was being insulted and reviled all day long by a worthless, unrestrained man, he made no reply and remained in the marketplace completing some urgent business. When he went home that evening unruffled, the man followed him, heaping abuse of all kinds upon him. Finally when Pericles was about to enter his house he turned to one of his servants and told him to take a light—for it was already dark—and escort the man back home. . . . These were not the only advantages which Pericles gained from his association with Anaxagoras. He also seems to have learned to hold himself above superstition, which is caused by terror of strange phenomena in the sky. Superstitious people are ignorant of the scientific explanations for these things, for they go out of their minds when it comes to the supernatural, and quake with fear because they are not used to seeing such phenomena. The study of physics removes their ignorance and replaces fearful and festering superstition with genuine unshakable piety accompanied by assurance that all will go well.

The story is told that the head of a one-horned ram was brought to Pericles from the countryside. Lampon the soothsayer, seeing the firm hard horn protruding from the middle of the forehead, said that there were two strong parties in the city—that of Thucydides and that of Pericles—and that power would devolve upon the man who had received this omen. Anaxagoras however had the skull cut through, and showed that the brain had not filled the cavity, but was oval in shape, like an egg, and had shrunk and receded to the place where the root of the horn grew out of the skull. At that time all present admired Anaxagoras, but a little later, when Thucydides was overthrown and Pericles was in full control of the state, their admiration shifted to Lampon. I think however that there is no reason why both the physicist and the soothsayer might not have been right. One of them came up with the reason for this phenomenon and the other with its purpose; for the aim of one was to seek its origin and how it had grown, and the aim of the other was to reveal for what purpose it had grown and what it meant.

193

Ibid. 8.1

Pericles regulated his speech so well that it was like a finely tuned musical instrument, harmonized with the rest of his life and with his loftiness of thought. He achieved this by frequently intoning the doctrines of Anaxagoras, pouring, as it were, the dye of physics over rhetoric. As the divine Plato says,[1] he acquired his way of lofty thinking and perfect action, over and above his natural gifts, from the study of physics; and by grafting on to the technique of rational thought appropriate material from the realm of physics he became far superior to all other speakers.

194

Ibid. 16.5

In the preceding paragraphs, Plutarch has given a description of Pericles' arrangements for his household.

These things then were surely done according to Anaxagoras' wise teachings, though Anaxagoras himself, because of his divine inspiration and high-mindedness, left his home and allowed his land to remain untilled and to become pasture for sheep.

However I think there is a real difference between the life of a philosopher and the life of a statesman. The philosopher, without implements or external resources, turns his thoughts to things that are perfect. The statesman on the other hand directs his talents to serve human needs; for him wealth is sometimes a necessity as well as an ornament, as it was for Pericles, who used his wealth to help many poor people. Thus they tell the story that Anaxagoras was lying neglected in his old age, starving to death, with his head already covered. At the time, Pericles was busy with his own affairs, but when he was informed of the situation he was shocked and immediately ran to Anaxagoras. He passionately entreated him not to give up, saying that he was lamenting not for Anaxagoras, but rather for himself, since he would lose such a good counselor in matters of state. Thereupon Anaxagoras uncovered his head and said to him, "Pericles, those who have need of a lamp must pour oil into it."

195

Ibid. 32.1

. . . Diopithes introduced a bill aimed at those who did not believe in the gods and who taught astronomical theories. In so doing, he tried to draw suspicion upon Pericles through Anaxagoras . . . Fearing for Anaxagoras, Pericles sent him out of the city.

196

Lysander 12.1

Some say that the fall of a stone was also a portent of this occurrence.[1] For it is generally believed that a huge stone fell from the sky at Aegospotami. It is still displayed today and the people of the Thracian peninsula still venerate it. It is told that Anaxagoras had predicted that one of the bodies which are fastened in the sky would break off, be hurled down, and fall to earth if any slipping or shaking were ever to occur. He said that the heavenly bodies are not in the part of space which they would naturally occupy, being heavy stones.[2] They shine because they have to force a path through the aether. They are kept in their orbits by external constraint, held fast by the intensity of the rotation. This is presumably the same mechanism that held them up and prevented them from falling down in the beginning when cold and heavy things were being separated out of the mixture. This explanation[3] agrees with the view of those few people who say that shooting stars are neither the fire of the aether which overflows or spreads out and is extinguished as soon as it enters the air and bursts into flame; nor a great quantity of air which rises to a very high altitude, expands, ignites, and bursts into flame; but rather that they are heavenly bodies which are hurled down and fall to earth when they are knocked out of place by a decrease in the intensity of their constrained motion, and that for the most part they land not on the inhabited areas of the earth but far out in the ocean—which explains why they are rarely observed.[4] There is, however, a more convincing explanation than this one[5] . . .[6]

Daimachus, in his books on piety, brings testimony in support of Anaxagoras' explanation.[7] He relates that for seventy-five consecutive days before the stone fell, a huge fiery body like a flaming cloud was seen in the sky. It did not stand still, but performed intricate and jerky movements, so that often, because of the lurches and turnings, fiery fragments broke off and fell flashing like shooting stars.

Now when the heavy stone landed at Aegospotami and the people of the area had recovered from their terror and shock, and gathered to see it, no effect or trace of all the fire observed in the sky was to be seen. There was nothing more than a stone lying there—large, to be sure, but retaining no remnant, so to speak, of its flaming course in the sky. It is clear then that Daimachus' account has to be read indulgently.

However, if his account is true, it thoroughly contradicts—whether they like it or not—those who say that it was a rock from the top of some high mountain, broken off by the winds and storms, borne aloft and wafted along like a pine-cone, and thrown to earth when the whirling began to decrease in intensity, falling when it stopped entirely. Unless, by Jove, it is true that a fiery object was seen for many days, and what it did was cause a perturbation in the air which produced violent winds and air currents when it was extinguished and disappeared; and these winds and currents hurled down the stone.[8] But detailed discussions like this belong in a book of a different type.

197

Nicias 23.2

No one published a clear and forthright account of the phases of the moon before Anaxagoras, though he was not one of the earliest great thinkers. Nor was *his* theory well-known; for it was still kept secret at the time of Nicias, and had currency only among a few people who spoke of it with great circumspection and secrecy. At that time physicists and so-called 'star gazers' were not tolerated, because they were thought to be undermining the divinity of the gods by introducing unthinking causes, forces which lack foreknowledge, and results brought about by the irresistible force of pure determinism. Indeed, Protagoras was prosecuted, Anaxagoras was imprisoned and rescued with difficulty by Pericles, and Socrates . . .

FROM A CHRONOLOGICAL INSCRIPTION

probably from the early part of the second century C.E.

198

No. 1297 in Vol. 14 of INSCRIPTIONES GRAECAE

Socrates the philosopher, Heraclitus of Ephesus, Anaxagoras, Parmenides, and Zeno lived . . .[1] years ago.

ASPASIUS

c. 100–150 C.E.

199

Commentary on Aristotle's ETHICS [CALLED AFTER NICOMACHUS] (*In* ETHICA NICOMACHEA *Commentaria*) 156.13 (*On* 1154b7)

"Animals always feel some pain."[1] The natural philosophers say this. For example, Anaxagoras said that animals always feel a kind of irritation because they constantly register sense perceptions. Aristotle's words here do not imply that he agrees with these natural philosophers.

He is simply investigating their theories. In fact, not all of them believe that animals always feel a kind of irritation. Theophrastus, in the *Ethics*, attacks only Anaxagoras for holding this view and points out in rebuttal that pleasures overcome pain.[2] This observation applies to specific pleasurable states which contrast with opposing painful states of an animal. For example, the pleasure derived from drinking drives out the painful state, thirst. The observation also applies to arbitrary states of pleasure, provided they are sufficiently intense. For example, the pleasure derived from the sense of hearing can drive away even hunger, if we sufficiently enjoy a song or any other sound.

JUSTIN MARTYR

c. 100–between 163 and 167 C.E.

200

Address to the Greeks (Cohortatio ad Graecos) 3

Anaxagoras of Clazomenae said that homoeomeries are the basic building blocks of all things.

FRONTO

c. 100–*c.* 166 C.E.

201

Letter on Rhetoric[1] *(De Eloquentia)* 12.19

. . . the pupil of Anaxagoras, not of Alexinus the fabricator of tales . . .

LUCIAN

c. 120–after 180 C.E.

202

Timon, or The Misanthrope 10

(Zeus:) I'll take care of those flatterers and punish their ingratitude towards Timon when I fix my thunderbolt, later. Right now its two largest rays are broken and blunted because the day before yesterday I threw it too violently at Anaxagoras, the sophist, who was trying to convince his students that we gods do not exist. But I missed him, because Pericles shielded him with his hand . . .

APULEIUS

c. 123–after 161 C.E.

203

Defense of Himself (Apologia) 27

These charges against philosophers result from a misunderstanding which is almost universal among ignorant people: they think that philosophers like Anaxagoras, Leucippus, Democritus, Epicurus, and other natural philosophers who seek plain, simple physical explanations are irreligious, and that they deny the existence of gods . . .

AULUS GELLIUS

c. 123–c. 165 C.E.

204

Nights in Attica (Noctes Atticae) 15.20

Theopompus says that . . . Euripides turned from physical training to the cultivation of his mind, and became a student of the physicist Anaxagoras and of the rhetorician Prodicus, as well as of Socrates in the study of ethics . . .

Alexander of Aetolia wrote these verses about Euripides: The nurseling of noble Anaxagoras was always solemn when he spoke with me./ He despised laughter and he had never learned to join in repartée, even when plied with wine./ Still, all his works were full of honeyed words and the enticing songs of Sirens.

MAXIMUS OF TYRE

c. 125–185 C.E.

205

Philosophical Discourses (Philosophumena) 16.1a

THESIS. That the philosophical life is better than the practical:

Were we debating this point before the bar of justice we would be brought before a judge who would be more like a tyrant than a true judge, and he would not allow each of us an equal defense; for indeed the ballots and lots of the court room are foreign to the philosopher and his way of life. Nevertheless, in philosophy too, argument strives with argument, and friend with friend. Therefore since philosophical inquiry bears some resemblance to litigation, let us allow one side of the argument to plead its case today. Let us allow a man of the philosophical life to defend himself against a charge just as if he were standing before a jury, and suppose the indictment read this way, or as close to this as possible:

Whereas Anaxagoras was born in the land and city of the Clazomenians, took part in their holy and solemn rites, had a share in their laws, in their food, and in the other things which the rest of the Clazomenians share; whereas he has retired from their company as one retires from the company of wild beasts, and does not associate with them in their public meetings or join them at the festivals of Dionysus, in the courtroom, or any other place where Clazomenians meet; whereas his land has become a sheep-pasture and his hearth is untended while he spends his time in solitude, contemplating and deepening his wonderful wisdom: therefore Anaxagoras has done wrong.

Suppose this is the form of the accusation and let the following, more or less, be the speech of Anaxagoras in his own defense:

I am not conscious of having done you any wrong, men of Clazomenae. I have not cheated you in financial matters, nor does my behavior in any way tarnish your city's reputation among the Greeks. In my private dealings with individuals among you, I think I have behaved in a harmless and mild manner, and I certainly have had great regard for the statutes of this city and for the form of government by which we are ruled. However, though I do you no wrong in the day to day pursuit of my way of life, I may be wrong in thinking that you will dismiss the charge against me of injuring the city's public welfare, and I may be wrong in thinking that if I did do wrong you would admonish me with private exhortation rather than with public prosecution.

I shall set out my case before you and shall hide nothing, even though you laugh heartily at me when I tell you of the passion of my life. I know that political power, participation in public life, open undisguised activity, and familiarity with public affairs are all valuable. Certainly I understand that these valuable pursuits are of great advantage to one who engages in them, provided they are accompanied by a virtuous and noble character; for otherwise they reduce the stature of their possessor, humiliate him, and force him to reveal his base intentions, inasmuch as power places a man in the limelight and exposes every misdeed. Accordingly if a person is sound in mind and has been successful in achieving prominence he can gain advantage from his power. But if one lacking good sense makes his goal the trappings of power he must fail, since he will always use his skill foolishly though he has ample means at his disposal.

Bearing these things in mind, I knew that I must take special care not to stumble and fall unwittingly into public affairs beyond my capacity. If you ordered me to sing in a chorus I would not be doing you wrong if I told you I would not join in the chorus until my voice was trained.

In the same way I neglected my land in order to better myself, turned to a way of life in which knowledge—illuminating the soul as light illuminates the eyes—provides a firm basis for conduct, and adopted this way of life as my own. To be sure, this light can be acquired . . .[1] we call Panathenaea. The way to it is open. The way to it is not through foolishness, or nonsense, or farming, or retailing, or participation in any common occupation, but through the love of truth, the contemplation of all that exists, and the pride which arises from such pursuits. I decided to travel this road and, following the teachings which guided me there, I carefully picked my way along the path. So much for my personal choice.

I shall now explain to you how, in pursuing this course, I have had your best and most just interests in mind. Your commonwealth is not quite secure even when your walls are in good repair, or when your shipyards are free from danger; or even when your ships at sea, your arcades, parks, gymnasia, temple precincts, and public treasures are safe. Even in the absence of enemies, fires, or other misfortunes, time carries all this away. What gives a state security is concord and stable government (Yes, even I think so!), and these are established by law and order. Law and order in turn are guaranteed only by the virtuous conduct of the citizens; virtue is gained through disciplined thinking; disciplined thinking through training; training through the knowledge of the truth; and the knowledge of the truth through the search for truth. There is no way virtuous conduct can be fostered except through truly rational thought, which sharpens and enkindles the mind, enabling it to pass from ignorance to understanding, from understanding to mastery, then to the ability to apply knowledge, and finally to complete truth. To retire for the sake of study is to pursue truth; it is to learn how to live, to strengthen the powers of rational thought, to educate the mind, and in general to acquire all the things necessary for true nobility.

You might argue that all this does not lead to perfection; or you might argue that it does, but that it can not be taught or learned through practice, being the kind of thing acquired only through chance or accident. In either case, the whole thing would be a farce and my conduct would merit an indictment. But no sane person would argue this way. For it is possible to attain to truth, to level-headed rational thinking, to virtuous conduct, and to knowledge of law and justice only through spending time at it; just as shoemaking can be learned only by devoting time to it, working bronze only by spending all day at the forge over the fire, and navigating only by going to sea and piloting a ship. In my pursuits then I do no wrong. If I withdrew from them however and allowed my *soul* to become a sterile 'sheep-pasture,' then certainly I would deserve to be indicted.

I have made what I think is a just and true defense, men of Clazomenae, and I beg you not to cast your ballots now, but to postpone the business at hand and to join me in contemplating the mysteries I study. If you profit from so doing, you will decide on that basis to drop the indictment. Otherwise you will cast your ballots as you see fit and I will act, nonetheless, in the best way, according to your decision.

When Anaxagoras completes this defense of his, the people of Clazomenae will in all likelihood laugh; for the indictment will still be more persuasive to them than his words. Yet, he will have spoken the truth even though they condemn him. But when the day comes in which one can become a judge not because he has drawn a lot, but because he has the one qualification which should be required of a judge, namely, knowledge; then and only then will any defendant—whether he be Anaxagoras in Clazomenae, Heraclitus in Ephesus, Pythagoras in Samos, Democritus in Abdera, Xenophanes in Colophon, Parmenides in Elea, Diogenes in Apollonia, or any other one of those admirable men—speak not as a criminal or as a condemned man . . .

AELIUS ARISTIDES

117/129–189 C.E.

206

On Rhetoric (De Rhetorica) 60.11

Anybody who wishes to show the worthlessness of this thing we call 'philosophy' could amass much material to support his arguments. For example, he might make a case against Diagoras and Anaxagoras, or anyone else who seemed crazy to the people of late or early times.[1] Some of these philosophers corrupted the people, some blasphemed the gods, some gave arguments better never thought of, and some spoke wildly and without sufficient deliberation.

207

Rebuttal of Plato's GORGIAS *(Pro Quattuor)* 124.15

I think that Pericles outdid all his contemporaries because he associated with Anaxagoras.

208

Ibid. 131.11

. . . Elsewhere . . . Plato maintains with some justification that Pericles became a perfect rhetorician because of his association with Anaxagoras.[1]

209

Ibid. 176.12

Miltiades was not well-versed in astronomy, unlike Anaxagoras; but neither was Socrates, even though they say he discoursed with Anaxagoras on these subjects.[1] Nevertheless, you will certainly grant that Socrates was not inferior to Anaxagoras . . .

210

Against Capito (Contra Capitonem) 324.3

[A direct quote of our source 8 from Plato.]

GALEN

129–?199 C.E.

211

On the Theories of Hippocrates and Plato (De Placitis Hippocratis et Platonis) 4.7

And so Posidonius adopted the saying of Anaxagoras: when somebody told him that his son had died he maintained his composure admirably and said, "I knew he was mortal when I begot him."

212

On the Body's Faculties (De Facultatibus Naturalibus) 1.2

A change from some initial state is a feature of all changes of state, just as preservation of the initial state is common to all states of rest. The Sophists acknowledge that food, when it becomes blood, is changed in appearance, taste, and texture, but they do not admit that it is truly changed . . . Others like Anaxagoras maintain that qualities inhere naturally in an underlying substance, and that these qualities are never changed or altered, but that the changes of quality which we see arise from processes of dissociation and recombination.

213

The Properties and Powers of Medicinal Herbs (De Simplicium Medicamentorum Temperamentis et Facultatibus) 2.1

They say that being human we must begin from the evidence of our senses, though it is not fitting to rely upon the senses in all cases, since one ought to go on to use reason, which is more divine . . .

Some of them cite Anaxagoras' statement that snow is not white as evidence, saying that, although he was a natural philosopher, he rose above sense perception and, scorning its fantasies, went on to use reason to investigate the nature of the universe.

214

The Functions of the Organs of the Human Body (De Usu Partium Corporis Humani) 1.3

Thus man is the wisest animal and his hands are organs befitting his wisdom. Man however is not the wisest animal because he has hands, as Anaxagoras said, but he has hands because he is wisest, as Aristotle said.

215

Ibid. 12.6

The creator knows just how ungrateful such men are, and yet he creates them. And the sun continues to regulate the seasons of the year and to ripen the fruits of the earth, paying no attention at all, I think, to Diagoras, Anaxagoras, Epicurus, or any of the others who have blasphemed it.

216

History of Philosophy[1] *(Historia Philosopha)* 3

Next, Anaximander aroused in Anaximenes enthusiastic admiration for his method, and equipped him to become the teacher of Anaxagoras, who in turn left Miletus, came to Athens, and first awakened in Archelaus the Athenian an interest in philosophy.

217

Ibid. 18

Anaxagoras of Clazomenae said that homoeomeries are the basic building blocks of matter.[1]

218

Ibid. 29

Concerning compounds, the older philosophers thought that when a compound is formed out of the elementary kinds of matter qualitative change takes place, i.e. the kind of change which occurs when a solution is made. Anaxagoras and Democritus and their schools say that it is when the elementary types of matter are juxtaposed that a compound is formed.[1]

219

Ibid. 35

Concerning God . . . Anaxagoras introduced a divine agent to order the universe: he says that God set in order the matter which was initially at rest, and he assumed that Mind, which did these things, is God.[1]

220

Ibid. 43

Anaxagoras and the Stoics say that chance is a factor human reason can not grasp: for some things occur because they must, some are fated, some result from deliberate acts, some result from chance, and yet others occur entirely of themselves.[1]

221

Ibid. 51

What is the reason the world is inclined to the plane of the ecliptic? Diogenes and Anaxagoras say that after the world had been put together, and animals had grown out of the earth, the world inclined, all by itself, toward the south. Perhaps this was a result of Providence, working to the end that some regions might be uninhabited and other inhabited, according to whether the climate is cold or hot.[1]

222

Ibid. 56

What are the planets and fixed stars made of? . . . Anaxagoras thought that the surrounding aether is a burning-hot gas whose intense whirling motion snatched up a stone from the earth, set it on fire, and turned it into a star.[1]

223

Ibid. 58

Concerning the motions of the heavenly bodies . . . Anaxagoras, Democritus, and Cleanthes believe that the heavenly bodies move from east to west.[1]

224

Ibid. 62

Concerning the sun . . . Anaxagoras, Democritus, and Metrodorus say it is a red-hot mass of stone or of ore.[1]

225

Ibid. 63

Concerning the size of the sun . . . Anaxagoras says that it is many times the size of the earth.[1]

226

Ibid. 65

Concerning the turning points in the course of the sun . . . Anaxagoras says that it makes (?) . . .[1] more resistant than (?) the compression due to the air in the north.[2]

227

Ibid. 67

Concerning the moon . . . Anaxagoras and Democritus say that it is a fiery solid body with plains, mountains, and gullies on it.[1]

228

Ibid. 71

What is the reason the moon seems to be composed of earth? . . . Anaxagoras says the reason is the unevenness of its composition since it contains cold and earth and there is murky substance mixed in it along with its fiery matter.[1]

229

Ibid. 74

Concerning the Milky Way . . . Anaxagoras says that the earth's shadow is cast upon this part of the sky when the sun does not illuminate the entire region underneath the earth.[1]

230

Ibid. 75

Concerning comets and shooting stars . . . Anaxagoras and Democritus say that a comet is a conjunction of two or more stars whose rays meet . . . Anaxagoras says that the so-called shooting stars are carried down from the aetherial fire like a spark and are immediately extinguished.[1]

231

Ibid. 76

Concerning thunder and lightning . . . Anaxagoras says that these phenomena occur when heat falls into the cold below, i.e. when a part of the aether falls into the atmosphere. Blackness is produced by the murkiness, lightning by the color of the clouds, and thunderbolts by a quantity of light.[1] Typhoons are produced by heat substance composed of yet more particles, and hurricanes attended with lightning are produced by cloudy substance.[2]

232

Ibid. 89

Concerning the rising of the Nile . . . Anaxagoras says the Nile rises because of the snow in Ethiopia which melts in the summer and remains frozen in the winter.[1]

233

Ibid. 123

How were animals created and will they ever disappear? Epicurus holds that if the world had been created out of nothing, then animals too would have been created out of nothing. If they could be annihilated . . .[1] the world was created out of nothing. Animals reproduce from one another, for they too are part of the world, as Anaxagoras and Euripides hold. Euripides writes: "Nothing which come to be dies, but one thing divides into others and exhibits different shapes."[2]

234

Ibid. 129

Does sleep belong to the body or the soul? . . . Anaxagoras says that sleep ensues when the activity of the body lags. Accordingly, sleep involves the body. Death involves the soul as well, occurring when the soul is separated from the body.[1]

235

On the Constitution of the Body (De Temperamentis) 2.589

. . . If they are looking for logical criteria to judge perceptible phenomena they had better turn immediately to the study of snow and decide whether they are going to say that snow is white, as it seems to be to everyone, or that it is not, as Anaxagoras asserted. And they must make similar studies of pitch, ravens, and all such things . . .

236

Commentary on Hippocrates' EPIDEMIOLOGY[1] *(In Hippocratis* EPIDEMIARUM *Libros)* 2 (V82.9–11L)

. . . We find that liquids become saltier and saltier as they are heated by fire or by the sun. Different liquids however become salty at different rates, according to their nature. Indeed, a liquid which becomes salty rapidly when it is heated—so that the salty taste quickly becomes pronounced—is not potable. Anaxagoras calls this salty taste "natronic," from the word "natron," because natron is a kind of salt.

IRENAEUS

end of the second century C.E.

237

Against Heresies (Contra Haereses) 2.14.2

Anaxagoras, nicknamed 'the atheist,' advanced the theory that animals are born from seeds which fall to earth from the sky. The Valentinian Gnostics say that this theory refers to the seed of their own Mother; they say that they themselves are this seed, and even among sensible people they constantly maintain that they are the seed of Anaxagoras the atheist!

SEXTUS EMPIRICUS

last third of the second century C.E.

238

A Course in Skepticism (Pyrrhonicae Institutiones) 1.33

To become a skeptic it is also necessary to show how logic contradicts perception, as Anaxagoras did. He set the observation that snow is white over against the known fact that snow is frozen water and water is black; and he concluded that snow is black.

239

Ibid. 3.32

. . . Anaxagoras of Clazomenae said that homoeomeries are the basic constituents of all things . . .

240

Ibid. 3.33

Since there is so much disagreement—and I have not shown all of it—among philosophers who claim they know the truth, we can choose to agree either with all the theories I have listed—and with all I have not listed as well—or with only a few of them. It is impossible however to agree with all of them. For we can not agree at the same time with Asclepiades and his school that the elementary types of matter possess certain basic qualities and can always be subdivided; *and* with Democritus and his school that the elementary constituents of matter are indivisible atoms which do not possess qualities; *and* with Anaxagoras and his school that these constituents are homoeomeries which possess all perceptible qualities.

241

A Treatise Against Scholars (Adversus Mathematicos) 7.89

. . . The natural philosophers of the school of Thales seem to have been the first to seek a criterion for truth. In many cases they rejected sense perception on the ground that it is untrustworthy, and set up logic as the only criterion for truth in the world. Logic became the starting point for their systematic investigations of basic concepts, of elementary kinds of matter, and of other such things. Accordingly, the greatest of the physicists, Anaxagoras, disparages the senses because they are weak, saying, "Because of their feebleness we are not able to determine the truth." To prove the unreliability of the senses he cites processes in which color changes gradually: if we take liquids of two colors such as black and white, and pour one into the other, drop by drop, the eye will not be able to discern the gradual changes which take place although changes are actually taking place . . . In general, then, Anaxagoras holds that reason is the criterion for truth.

242

Ibid. 7.140

Diotimus says that according to Democritus there are three ways to reach the truth: (1) through observed phenomena, which lead to the discovery of the unseen. Thus Democritus praised Anaxagoras for having said that observed phenomena are the manifestations of the unseen; (2) . . .

243

Ibid. 9.4

. . . those who seem to have developed the most penetrating physical theories concerning the basic elements of the universe say that some of them are forces which cause things to happen, and some are material. The first to have lit upon this view is thought to be the poet Homer, and after him Anaxagoras of Clazomenae, Empedocles of Acragas, and many, many others . . . Anaxagoras says, "All things in the universe were together; then Mind came and set them in order," since he assumes that Mind, which according to him is God, is that which makes things happen, and that the motley mixture of homoeomeries is the material out of which things are made.

244

Ibid. 9.360

Among those who say that the basic components of existing things are material particles . . . Anaxagoras of Clazomenae says they are homoeomeries.

245

Ibid. 10.45

Down-to-earth people, who rely on perceived phenomena, as well as most of the physicists, like Pythagoras, Empedocles, Anaxagoras, Democritus, and Epicurus . . . hold that motion and change are real.

246

Ibid. 10.318

Anaxagoras of Clazomenae, Democritus, Epicurus, and many others, together with their followers, maintain that things are formed of an infinite number of constituents. However, Anaxagoras holds that the constituents are the same as the things they compose . . .

ATHENAEUS

fl. *c.* 200 C.E.

247

The Philosophers' Table Talk (Deipnosophistae) 2.57d

Anaxagoras, in his *Physics*, says that what people call 'bird's milk' is really the white of eggs.[1]

248

Ibid. 2.87[1]

Concerning the rising of the Nile . . . the physicist Anaxagoras says that the Nile becomes swollen by melting snows, and Euripides and other tragic poets concur. Anaxagoras only gives the cause of the rising, while Euripides specifies the place where it starts[2] in the drama *Archelaus*[3]: "Danaus, father of fifty daughters,/ left the land of the most beautiful of rivers, the Nile,/ which is filled up in the summer with water from Ethiopia,/ the land of dark people, when the snows melt/ as the Sun goes riding with his four-horsed chariot over the land." He says similar things in the *Helen*[4] . . . Callisthenes the historian objected to the opinions of Anaxagoras and Euripides brought above.

249

Ibid. 5.220b

Callias, by Socrates' student Aeschines, contains an argument between Callias and his father, as well as sweeping ridicule of the sophists Prodicus and Anaxagoras. In it Aeschines says that Theramenes was a student of Prodicus and that Philoxenus, the son of Eryxis, and Ariphrades, the brother of the cithara-player Arignotus, were students of Anaxagoras; and he implies that the bad character and empty greed of these men reflected the education they received from their teachers.

CLEMENT OF ALEXANDRIA

c. 150–between 211 and 216 C.E.

250

Exhortation to the Heathen (Cohortatio ad Gentes) 5

Other philosophers went beyond the basic kinds of matter to deal with higher and less common things. Some of them spoke rapturously of an infinite entity. Among them were Anaximander of Miletus, Anaxagoras of Clazomenae, and Archelaus of Athens. The last two said that Mind controls the infinite universe.

251

Miscellanies (Stromata) 1.63

After Anaximenes comes Anaxagoras, son of Hegesibulus of Clazomenae. He transferred the school from Ionia to Athens.

252

Ibid. 1.78

. . . Some people say that Anaxagoras, the son of Hegesibulus of Clazomenae, was the first to publish a book.[1]

253

Ibid. 2.14

The Greeks however did not realize that the basic factor primarily responsible for all things had already been discovered. Thales . . . did not, nor did the other later physicists. Anaxagoras was admittedly the first to say that Mind controls all things. However, not even he maintained the dignity of the factor which fashions all things unimpaired, but he pictured foolish eddies complementing the idleness and mindlessness of Mind.

254

Ibid. 2.130

They say that Anaxagoras of Clazomenae held that contemplation, and the detachment that results from it, constitute the aim of life . . .

TERTULLIAN

c. 160–*c.* 225 C.E.

255

Psychology (De Anima) 12.1

. . . We understand by 'mind' (or perhaps 'intellect' is what the Greek *nous* means) precisely that innate core of life found in the living being and by nature proper to it. Through it the living being acts, knows, and perceives. It is because a living being contains within itself a mind that it can move itself as if without the aid of an external agent, though when a living being moves, it appears that the mind that moves it is something whose properties are entirely different from its own. Those who say that Mind is the source of motion and change in the universe—as is Socrates' God and Valentine's Only-begotten-son of the Father Abyss and the Mother Silence—do indeed hold that mind is entirely different from life in its properties. Anaxagoras' opinion however is very confused. He considered Mind to be the basic factor primarily responsible for all things, made the rotation of the universe dependent upon it, and asserted that it is pure, simple, and free from admixture; so that he certainly also regarded it as being free from any admixture of life. On the other hand there are places where he identifies Mind with life. Aristotle mentioned this too,[1] though I do not know whether he did so because he was eager to give an exhaustive account or because he was anxious to expose the foolishness of others . . . Our conclusion must be that it is possible for mind to be mixed with other things, contrary to the opinion of Anaxagoras . . .

256

Ibid. 43.2

Anaxagoras and Xenophanes say that sleep is fatigue . . .

257

Against the Heathens (Adversus Gentes) 46

To draw comparisons in matters of good faith: Anaxagoras refused to return a deposit to his friends,[1] while a Christian is said to be trustworthy even in the affairs of people who are strangers to him.

AELIAN

c. 170–235 C.E.

258

On Animals (De Natura Animalium) 7.8

Another story about how rain was predicted, told all over Greece, is how Anaxagoras wore a leather overcoat when he was watching the games at Olympia, and rain began to fall. Thereafter all the Greeks boasted that Anaxagoras had supernatural insight rare among mortals.

259

Miscellanies (Varia Historia) 3.2

Someone came up to Anaxagoras as he was busy lecturing to his students and told him that his two sons—mind you, the only children

Anaxagoras had—had died. He remained unperturbed and said, "I knew they were mortal, having begotten them."

260

Ibid. 8.13

They say that Anaxagoras of Clazomenae was never seen to laugh or even to smile, until later in life.

261

Ibid. 8.19

The following is Anaxagoras' epitaph: Here lies Anaxagoras, whose picture of the order of the universe came closest to the truth.

PHILOSTRATUS

c. 170–between 244 and 249 C.E.

262

Apollonius of Tyana (Vita Apollonii) 1.2

The fact that Apollonius was able to predict and know the future does not mean that he can be charged with practicing magic. If it did, Socrates too could be charged with practicing magic because he was told of things to come by his 'spirit,' and Anaxagoras as well because of his predictions. Who does not know that Anaxagoras appeared in the stadium at Olympia wrapped in a sheepskin, when it was not even drizzling, as if to say that it was going to rain?[1] Who does not know that he predicted that a house would fall and was proved right when it did, and that when he predicted that day would turn into night and that stones would be ejected from the sky near Aegospotami, these predictions too were vindicated? Although people grant that the scientific knowledge of Anaxagoras was responsible for such feats, they refuse to admit that Apollonius made his predictions by using scientific knowledge . . .

263

Ibid. 1.13

After he had mended his relations with his brother, Apollonius turned to his other relatives and won over the poor ones by giving them most of his possessions, leaving but little for himself. He remarked when he did this that Anaxagoras of Clazomenae had been a philosopher more for sheep than for men, since he abandoned his property to cattle and sheep, and that Crates of Thebes was of no use either to men or to sheep since he threw his possessions into the sea.

264

Ibid. 2.5

"Indeed, Apollonius," Damis said, "I thought I would be wiser after I came down the mountain since I had heard that Anaxagoras of Clazomenae observed the stars from Mount Mimas in Ionia . . ."

265

Ibid. 8.7

What will the two Ionian philosophers Thales and Anaxagoras say for themselves? For the former predicted an abundant olive crop and the latter many celestial phenomena. Will they say that they predicted these things through the use of magic? Certainly not. Even when they[1] were brought to trial it was on different charges altogether, and nowhere in the indictments is it even hinted that because they predicted things they were magicians.

266

Lives of the Rhetoricians (Vitae Sophistarum) 1.21: *Scopelianus of Clazomenae*

. . . Scopelianus used to say that Anaxagoras' possessions became pasture for sheep while his own became pasture for slaves.

ORIGEN

prob. 185/186–254/255 C.E.

267

A Reply to Celsus' Attack on Christianity (Contra Celsum) 4.77

Thus we see that Jews and Christians were not the only ones to speak of the sun and moon as servants of mankind; for so did the man who, according to some people, was called the philosopher-playwright[1] and had learned natural philosophy from the lectures of Anaxagoras . . .

268

Ibid. 5.11

Indeed we will not dishonor these great handiworks of God, nor will we call the sun, moon, and stars red-hot masses of ore as Anaxagoras did . . .

269

Ibid. 7.36

Euripides was ridiculed by Aristophanes for being an inept writer because he often put philosophic arguments—which he had learned from Anaxagoras or some other wise man—into the mouths of foreigners, women, or slaves.

ORIGEN (HIPPOLYTUS?)[1]

270

A Refutation of All Heresies (Refutatio Omnium Haeresium)
1, epitome, 3

The natural philosophers are Thales, Pythagoras, Empedocles, Heraclitus, Anaximander, Anaximenes, Anaxagoras, Archelaus, Parmenides, Leucippus, Democritus, Xenophanes, Ecphantus, and Hippo.

271

Ibid. 1.8

After Anaximenes comes Anaxagoras of Clazomenae, son of Hegesibulus. He said that the primary constituents of the universe are Mind and matter: Mind, which is responsible for the disposition of things, and matter, which undergoes physical change.[1] He held that when all things in the universe were together, Mind came and set them in order. He says that the basic building blocks of matter are infinite, and the smaller ones of them are infinite.[2] All things move because they are moved by Mind; and the motion makes similar substances come together.

The heavenly bodies were set in place by circular motion. Dense, moist, dark, cold, and, in general, heavy things collected at the center, and earth was formed from them when they coalesced. Things contrasting with these—hot, light-colored, dry, and light ones—rose to the outer part of the aether. The earth is flat in shape. It stays up because of its size, because there is no void,[3] and because the air, which is very resistant, supports the earth, which rests on it. Now we turn to the liquids on the earth: The sea existed all along, but the water in it became the way it is[4] because it suffered evaporation, and it is also added to from the rivers which flow into it.[5] Rivers originate from rains and also from subterranean water; for the earth is hollow and has water in its hollows.[6] The Nile rises in the summer because water is carried down into it from the snow in the north.[7]

The sun, the moon, and all the heavenly bodies are red-hot stones which have been snatched up by the rotation of the aether. Below the heavenly bodies there exist certain bodies which revolve along with the sun and the moon and are invisible.[8] The heat of the stars is not felt because they are far away, at a great distance from the earth. Furthermore, they are not so hot as the sun, being in cooler regions.[9] The moon is below the sun, closer to us. The sun is larger than the Peloponnesus. The moon does not shine with its own light, but receives its light from the sun.[10] The stars go under the earth in their course. Eclipses of the moon occur when the earth cuts off the light, and sometimes when the bodies below the moon cut off the light. Eclipses of the sun take place at new moon, when the moon cuts off the light. The sun and moon reach turning points in their courses when they are forced back by the air. Often the moon turns when it can not prevail over the cold.[11] Anaxagoras was the first to describe the circumstances under which eclipses occur and the way light is reflected by the moon. He said that the moon is made of earth and has plains and gullies on it. The Milky Way is the light of those stars which are not lit up by the sun. Falling stars are produced like sparks, flying off from the heavens as they move.

Winds blow when the air is rarefied by the heat of the sun, i.e. when the hot currents are carried off and reach the sky. Thunder and lightning are produced when heat falls into the clouds. Earthquakes occur when air from above the earth falls below the earth; for when the air below the earth is agitated, the earth, which rests on it, trembles.[12]

In the beginning animals came to be out of the moisture. Later they reproduced from one another. Males are born when sperm emitted from the right testicle sticks in the right side of the womb, and females are born when the opposite occurs.

Anaxagoras reached the pinnacle of his career[13] in the first year of the eighty-eighth Olympiad,[14] at the same time Plato is said to have been born. They say Anaxagoras was also a prophet.[15]

272

Ibid. 1.9

Archelaus, the son of Apollodorus, was an Athenian by birth. He said the same things Anaxagoras did about the mixture of matter and the primary constituents of the universe.

273

Ibid. 10.7

Anaxagoras of Clazomenae, Democritus, Epicurus, and many others, together with their followers, believed that the totality of things is formed of an infinite number of components. We have treated them all in detail above. However, Anaxagoras holds that the constituents are the same as the things they compose.

CENSORINUS

third century C.E.

274

An Essay on Birthdays (De Die Natali) 5.2

Accordingly there is no agreement among natural philosophers about the place where semen is produced: Parmenides thought that it is produced sometimes on the right side and sometimes on the left. According to Hippo of Metapontum (or perhaps of Samos, as Aristoxenus says) semen is produced in the marrow. He brings as proof the fact that if a bull is killed after it has mated, no marrow is found because, according to him, it has been used up. However, some people like Anaxagoras, Democritus, and Alcmaeon of Croton oppose this view and say that after a bull engages in any strenuous effort at all not only its marrow, but also its fat and much of its flesh is wasted away.

Authors also disagree on whether offspring are produced only from the seed of the father, as the Stoics, Diogenes, and Hippo wrote, or from the seed of the mother as well, as Anaxagoras and Alcmaeon, as well as Parmenides, Empedocles, and Epicurus believed. Despite the fact that Alcmaeon held it to be impossible to observe what part of the foetus develops first, he said he knew the details of embryonic development. Empedocles, whom Aristotle follows in this, believed that the heart is the first organ to be formed because it is most of all the seat of life in man. Hippo, however, thought that the head is formed first, since the mind is located chiefly in the head. Democritus held that the belly and the head are formed first, because they contain the most empty space. Anaxagoras thought that the brain is formed first, since all the senses have their seat in the brain. Diogenes of Apollonia thought that first, flesh is formed out of the liquid, and then bones, muscles, and all other tissues arise from the flesh. The Stoics said that all parts of the foetus are formed at the same time, just as it is born and nourished as one entity. There are some, like Aristotle and Epicurus, who say that the foetus develops naturally, without the intervention of an external agency. Others say, as do almost all the Stoics, that this development is the actualization of the potential residing in the spirit which accompanies the semen. Still others, following Anaxagoras, say that aetherial heat resides in the semen and determines the disposition of the organs.

Setting aside the question of how the foetus develops, there are two opinions about the way it receives nourishment while it is in its mother's womb. Anaxagoras and many others think that food is administered to it through the navel . . .

Anaxagoras and Empedocles agree that males are born from semen emitted from the right testicle, and that females are born from semen emitted from the left. Their opinions, although they coincide here, diverge in regard to the resemblance of children to their parents . . . Anaxagoras thinks that children resemble that parent who has contributed most seed.

MINUCIUS FELIX

some time between the middle of the second century and the middle of the third century C.E.

275

A Defense of Christianity (Octavius) 19.6

They say that for Anaxagoras God was infinite Mind which fashions distinct objects and is the source of motion and change.

SOLINUS

fl. soon after 200 C.E.

276

A Book of Marvels (Collectanea Rerum Memorabilium) 40.6

Among the men of exceptional talent from Asia who were famous throughout the world were . . . Anaxagoras, who explained natural phenomena . . .

PLOTINUS

205–269/270 C.E.

277

Philosophical Essays (Enneades) 2.4.7.2

Anaxagoras considers the mixture to be a liquid substance[1] which he says is not capable of turning into anything else, but rather contains everything already, in actuality. He debases the Mind, which he brings into the picture, by not making it the factor which gives things their shapes and properties, and by not making it prior to matter, but on the same level with it.[2]

It is impossible for Mind to be on the same level with matter: if the mixture has existence as an attribute, existence must be prior;[3] if, however, existence and the mixture are independently existing entities, then *their* existence must be a third thing, different from either of these two.

Again, since the Creator must be prior in any theory, why did Anaxagoras have to say that matter existed all along in the form of tiny particles completely endowed with all their properties, and that Mind then penetrated the disorganized mass and formed distinct objects? He could as well have said that pure matter is completely devoid of all attributes, and that Mind endows it with qualities as well as shapes.

Moreover, it is certainly impossible for all things to be in all things. Also, Anaxagoras assumes the existence of something infinite; but how is 'infinite' to be taken? If it is to be taken in the sense of boundlessness, then it is evident that there can be no such thing as an infinite object; for among existent things there is no object which is inherently infinite, nor is there any object which is infinite by virtue of an accidental relation to some infinite material object: it is impossible for there to be an object which is inherently infinite, because in that case it would also necessarily have infinite parts; and it is impossible for a thing to be infinite through an accidental relation, because it is clear that the thing to which it would be related would have to be inherently infinite—which is impossible, if it itself is not to be infinite by virtue of an accidental relation to something else,[4] or indeed if it is to be material.

Anaxagoras' atoms, however, will not even be on the level of matter, since they do not exist at all; for in his theory every material body is totally subdivisible.[5] Moreover, this theory can be attacked for holding that these particles form a continuum; for holding that they are moist;[6] for maintaining that individual objects can not exist without the agency of Mind and Life—and note that Life cannot be composed of indivisible particles, for something so utterly different from the atoms could not possibly be made out of the atoms, and no Creator can make anything without using matter, which must of course be continuous;[7] and for a thousand other things. Indeed Anaxagoras' theory has been attacked on all these counts; therefore, it is superfluous to spend more time on it.

278

Ibid. 5.1.9.1

When Anaxagoras says that Mind is pure and free from admixture, he too is assuming that that which is primary is pure, and that that which is one must not be connected with matter. Anaxagoras, however, did not write this clearly because he lived so long ago.

HARPOCRATION

prob. not later than the third century C.E.

279

Dictionary of the Ten Major Athenian Orators (Lexicon in Decem Oratores Atticos) s. v. Anaxagoras

Anaxagoras: A sophist, the son of Hegesibulus, from Clazomenae, a pupil of Anaximenes of Miletus. He was given the name 'Mind' since he said that matter and Mind preserve and uphold the permanent existence of all things. He is the one who said that the sun is a red-hot mass of ore.

ALEXANDER OF APHRODISIAS

fl. early third century C.E.

280

Essay on Fate (De Fato) 165.14

It is quite generally assumed that such a thing as Fate exists and causes those things which are fated. Now a belief intuitively held by all men can not be completely worthless or incapable of revealing some truth. On the contrary, a common store of intuitive beliefs forms the basis of communication between people, if they have not been compelled to differ on a given subject by a stand previously taken which they are unwilling to abandon out of a desire to be consistent. This is why Anaxagoras of Clazomenae—although he is a reputable natural philosopher—can not be relied on when he says, in defiance of the common belief that Fate exists, that nothing is fated and that the word 'fate' is meaningless.[1]

281

On the Constitution and Growth of Living Things (De Mixtione) 2.11.23

Some natural philosophers say that the infinitely numerous particles are not atoms, but certain things called 'homoeomeries,' from which perceptible bodies are formed by coalescence and synthesis. Anaxagoras and Archelaus seem to be of this opinion.

282

Ibid. 228.15

If it is true that only substances can be separated from one another, then only substances can be mixed with one another. Anaxagoras would not, then, be correct in saying that all things are mixed together in all things, since qualities can not exist separately . . .[1]

283

Commentary on Aristotle's ON THE INANIMATE WORLD *(In Aristotelis* METEOROLOGICORUM *Libros*) 8.22 (*On* 339a27)[1]

Aristotle accepts Anaxagoras' name for the kind of matter in the heavens, 'aether,' but he rejects his assumption that the heavens are called 'aether' because they are heat and burn, which implies that they are made of heat substance, rather than because they run eternally, that is, move unceasingly.

284

Ibid. 26.11 (*On* 342b25)[1]

. . . Anaxagoras and Democritus say that the phenomenon called 'a comet' is a conjunction of planets. The planets are Saturn, Jupiter, Venus, Mars, and Mercury. When these approach one another, they appear to touch and look like one heavenly body, a so-called comet. He means by 'a conjunction' the phenomenon of two or more objects approaching one another so as to seem to be one thing.

285

Ibid. 29.5 (*On* 343a20)

. . . whether a comet is a conjunction of planets, as Anaxagoras and Democritus think . . .

286

Ibid. 32.3 (*On* 343b8)

Aristotle is saying that Democritus agreed with Anaxagoras that a comet is a conjunction of planets . . .

287

Ibid. 37.28 (*On* 345a11)[1]

Anaxagoras and Democritus say that the Milky Way is the light of certain stars. They say that at night, when the sun goes under the earth, its rays shine upon some of the stars above the earth, mask their light, and prevent them from being seen. The stars shielded by the earth's shadow are hidden from the light of the sun and are not illuminated by it. These stars therefore are visible, and their light is the Milky Way.

288

Ibid. 49.9 (*On* 347b34)[1]

It is evident that hail is ice, that is, water in a solid state. As we have said, it seems inconsistent with this fact that it hails in warm weather rather than in cold weather and it is difficult to see how so much water can remain suspended in the air long enough to freeze. For these reasons, some people—among them Anaxagoras—say that hail falls, and freezes the way it does, because clouds are thrust to colder, higher altitudes by the warmth surrounding the earth below.

289

Ibid. 50.17 (*On* 384a36)[1]

Aristotle has given arguments against Anaxagoras' theory that hail is formed far above the earth—where it is very cold—when clouds thrust upwards by the heat around the earth condense into water, which then freezes because of the cold at those heights. Aristotle now proceeds to give his own theory.

290

Ibid. 51.16 (*On* 348a36)

Next, Aristotle says that the facts disagree with the theory brought earlier, held by Anaxagoras, among others. Anaxagoras said that hail forms when a cloud is thrust into the colder, higher altitudes by the heat around the earth.

291

Ibid. 67.17 (*On* 353a32)

The third theory about the sea is that its water becomes salty as it filters through the earth and washes over it, since the earth contains substances which have a salty taste. As evidence for this theory its supporters bring the fact that salts and sodium carbonate are dug out of the earth, and that earth often has a pungent taste. Anaxagoras and Metrodorus held this opinion . . .

292

Ibid. 114.7 (*On* 365a14)[1]

Here too, as usual, Aristotle begins by describing and criticizing earlier theories concerning earthquakes. He says that up to his time three such theories had been proposed by three different men: Anaximenes of Miletus was the first to discuss earthquakes, Anaxagoras of Clazomenae second, and Democritus of Abdera third. This is the theory of Anaxagoras: he says that aether normally rises, so that when it falls into subterranean caverns it moves the earth. In his theory 'up' refers to the surface of the earth on which we live, and 'down' to the part of space below the surface of the earth and to its lower surface. He says that the surface upon which we live has been clogged and smoothed over by rain, while the under surface is porous and pocked, earth being normally porous. Therefore the aether under the earth enters the hollow, porous parts of the earth on its upward path—since aether normally rises to the regions above—and moves the earth, causing earthquakes. All these things are based on the assumption that the earth is flat, and that because it is flat it can remain motionless in its place supported by the air below it.

293

Ibid. 129.15 (*On* 369b11)[1]

After giving his own theory of thunder and lightning, Aristotle brings other theories. He says that some people think that thunder and lightning are caused by fire trapped in the clouds. According to Empedocles, the fire caught in the clouds comes from the rays of the sun, while Anaxagoras says that some of the aether above—which he says is fire—is carried down to the level of the clouds. In his book on astronomy too Aristotle says that aether, which is the kind of matter responsible for rotational motion, was identified by Anaxagoras with heat, because Anaxagoras thought that the word 'aether' is derived from 'burn' and not from 'run eternally.'[2] Anaxagoras holds that the glow of this fire which is caught in the clouds is lightning, and that thunder is the sputtering noise heard when it is quenched in the clouds. The assumption here is that thunder and lightning occur in the order in which they seem to occur, lightning first and thunder second. Having set forth these views, Aristotle shows that they are completely absurd. First of all, he says that the opinion held by both of them that lightning is fire caught in the clouds is illogical. According to Aristotle, however, the most illogical thing is Anaxagoras' statement that a portion of the aether descends. Aristotle adds the reason this assertion is so absurd: there must be a reason why something which normally rises descends, i.e. moves in a direction it would normally never take, and Anaxagoras should have told us what this reason is . . .

294

Commentary on Aristotle's ON SENSE PERCEPTION (*In Librum* DE SENSU) 68.5 (*On* 441a3)

Those who agree with Anaxagoras that all things are mixed in all things say that all things come to be from all things by a process of extraction. They do not however hold that different substances can come from one kind of tissue; rather, Anaxagoras says that bone is formed when pieces of bone matter extracted from a composite body coalesce with one another, and muscle when pieces of muscle matter from the same composite body coalesce in the same way. But of course in his theory muscle is not formed when bone matter coalesces.

295

Commentary on Aristotle's FOUNDATIONS OF SCIENTIFIC THOUGHT (*Commentaria In Aristotelis* METAPHYSICA) 27.26 (*On* 984a11)[1]

Aristotle is saying that Anaxagoras was born before Empedocles, and was after him in his philosophical activity; that is, that Anaxagoras was second to him as a natural philosopher. Aristotle says this because he sees no grounds to prefer Anaxagoras' theory to Empedocles' since it displays no greater comprehension and is in no way superior. Rather, Aristotle considers Anaxagoras' theory second-rate and altogether inferior.

Elsewhere[2] he explains that he prefers Empedocles' theory because Empedocles explains all the same phenomena with the aid of a finite number of elementary constituents of matter. For Aristotle assumes that it is better to work with a finite number provided that one can account for all the phenomena equally well with a finite number. However in some places Aristotle prefers Anaxagoras to Empedocles. But in our passage he seems to be saying that Anaxagoras was after Empedocles in his philosophical activity, because he postulated an infinite number of elementary constituents of matter, for right after this brief introductory passage Aristotle says that Anaxagoras postulated the existence of an infinite number of elementary constituents of matter.

Later, however, Aristotle shows that Anaxagoras' point of view agrees with that of Plato, who came after him. Aristotle explains that it is possible to deduce from Anaxagoras' words that he meant the basic concepts in his theory to be 'the one' and 'the undifferentiated,' and he adds: "His words imply views which resemble those of later thinkers, and theories which are most reasonable."[3]

It seems that "Anaxagoras says that the great majority of homoeomerous substances like clear liquid, and heat," and indeed each of the four elementary kinds of matter, are made and decompose by processes of dissociation and recombination, since each of these substances is formed by the coalescence of a large number of identical particles. Aristotle says that Anaxagoras thinks that this is the way homoeomerous substances—which are infinite in number and eternal—are made and decompose: they are formed by the coalescence of a large number of identical particles, and decompose when these particles dissociate. Aristotle talks of "the great majority of homoeomerous substances" because Anaxagoras did not assume that all of them are elementary kinds of matter. At any rate—as one can see from the plain meaning of the text—he held that clear liquid, heat substance, dry dust, and colorless gas, which are homoeomerous substances, are not elementary kinds of matter, but compounds.

296

Ibid. 28.22 (*On* 984a16)

"From all these theories"—i.e. from those which have been stated—"one might conclude that the only important factor to be considered in explaining things is the kind of matter involved"; for Aristotle has been talking of elementary material substances. However in the meantime he has brought up Empedocles and Anaxagoras, who in addition introduced factors responsible for fashioning objects, although Aristotle has mentioned them only in order to tell us the kinds of matter each posited as basic and how they differed from their predecessors. For Aristotle does not approve of these two either, because they give an insignificant role in their theories to these factors and do not use these factors to explain the detailed processes by which objects are built up out of elementary kinds of matter.

297

Ibid. 29.12 (*On* 984a27)

Anaxagoras and Empedocles seem to have spoken about a factor which fashions all things and which is responsible for their structure, as Aristotle will remark later.

298

Ibid. 31.18 (*On* 984b5)

Aristotle is not talking here about those who explicitly postulated the existence in the world of a factor responsible for fashioning all things, i.e. about Anaxagoras and Empedocles . . .

299

Ibid. 32.6 (*On* 984b8)[1]

. . . Natural philosophers were drawn on, led, and compelled, as it were, by the true nature of things to search for the next basic element required in any explanation of nature. By "the second factor Aristotle means the factor which comes after the basic constituents of matter, and completely explains all physical change inasmuch as it fashions all things. Anaxagoras, who said that Mind is responsible for the formation of all that exists, was admired as the only one who spoke with reason at a time when others whose theories did not include such a factor stammered like drunkards.

Aristotle adds "just as animals do" because in animals which have a mind, the mind is the origin of their successful functioning and responsible for their doing things properly. He says that it seems Anaxagoras was clearly the first to discover this factor, but that nevertheless Hermotimus, his fellow citizen, mentioned it before him. Both assumed not only that this factor is responsible for fashioning all things, but also that it originates the perfectly ordered formation of all things which are formed and is responsible for all that exists; and, to be sure, these are properties of the mind. Thus they mean that this factor brings about that tendency toward a perfect state which is caused, of course, by the factor which makes things what they are; for they held that this factor is the source of *perfection*, motion, and physical change, and not of motion and physical change alone; and, to be sure, these are properties of the mind . . . However, while Anaxagoras assumed that the factor which makes things what they are is perfect, Hesiod and Parmenides, who assert that love and desire are such factors, really only talk of them as perfect in the sense of being perfect final states toward which all things tend . . .

300

Ibid. 33.9 (*On* 984b29)

It remains to be determined, Aristotle says, who first introduced this factor into his theory: Anaxagoras, as it seems, or Hermotimus before him, or Hesiod and his school before them.

301

Ibid. 33.27 (*On* 984b32)[1]

Aristotle is saying that Empedocles and Anaxagoras, and even Hermotimus and the poets Hesiod and Parmenides, included in their theories in addition to matter a factor which fashions things. Aristotle says that he has spoken about these things in his book on physics, and that the theories these thinkers held all fall within the limits of that discipline. However, these thinkers make only vague, unclear, and sparse use of the factor which fashions all things. In order to substantiate this statement Aristotle adds: "none of them makes much use of either of these two factors[2] in his theories" . . . Aristotle reminds us that Anaxagoras and Empedocles do not make use of these factors, which appear in their theories. This points back to his earlier statement that "one might conclude from all this that the only important factor to be considered in explaining things is the kind of matter involved." And he has said in the meantime that Anaxagoras uses Mind like a device, like a *deus ex machina* introduced into a play to resolve a hopeless situation.[3] Thus Aristotle; and he says the same thing about Anaxagoras as Plato does in the *Phaedo*.[4]

302

Ibid. 35.6 (*On* 985a21)[1]

Aristotle says that Empedocles made more use in his theory of factors responsible for fashioning things than Anaxagoras did . . .

303

Ibid. 45.26 (*On* 987a2)

Aristotle is speaking of those who posit in addition a source of motion. He is referring to Anaxagoras, and to others who include Mind among the basic elements of their theories as a factor responsible for fashioning all things . . . Thus, as Aristotle has already remarked, one of them namely—Anaxagoras—assumed a single factor which fashions all things . . .

304

Ibid. 46.15 (*On* 987a9)

Aristotle is saying that before the Pythagoreans advanced their theory most thinkers were very sloppy in their treatment of factors necessary for a complete explanation of things, i.e. they postulated the existence of only one such factor—the kind of matter involved. The only two exceptions are Anaxagoras and Empedocles, who postulated in addition to matter the existence of a factor which fashions things; one of them, Anaxagoras, held that there is one such factor, while the other, Empedocles, made out of it two. Aristotle tells us this in the words, "However, as I have remarked above, there do happen to be some who postulated two such factors; of these some say that there is only one additional factor which originates motion and change, and some say that there are two" . . .

305

Ibid. 60.20 (*On* 988a14)[1]

Aristotle reminds us that there were earlier people who sought such a factor and who discussed it, when he says, "some of the earlier philosophers too, like Empedocles and Anaxagoras." . . . For Anaxagoras, Mind is the one source of perfection and of complete defectiveness,[2] as Aristotle says.

306

Ibid. 61.17 (*On* 988a28)[1]

Anaxagoras was one of those who assumed that the most important characteristic of each thing is the material out of which it is made.

307

Ibid. 61.24 (*On* 988a32)[1]

"These people clearly set out to explain only what bodies are made of." Aristotle is probably referring in this sentence to the same people he spoke of above where he speaks of "those also who held that the fundamental kind of matter is either colorless gas, or heat substance, or clear liquid, or something heavier than heat and lighter than gas." This is likely since the other people Aristotle has just mentioned did not only explain what bodies are made of; Anaxagoras did not, nor did the Pythagoreans, nor did Plato. Aristotle adds that some others speak of "a source of motion and change," that is, a factor which fashions all things, and that among these are philosophers who introduced Affinity and Repulsion, as Empedocles did, or Mind, as Anaxagoras did, or Love, as Parmenides and Hesiod did.

308

Ibid. 62.1 (*On* 988a34)[1]

Having said that Anaxagoras and Empedocles spoke about a factor which fashions things, as well as about matter . . .

309

Ibid. 63.8 (*On* 988b6)[1]

Anaxagoras, who introduced Mind, and Empedocles, who introduced Affinity, assumed that these factors are perfect and that they are the source of all perfection. But they did not mean that these represent final states toward which all things subject to physical change tend, but only that they are factors which can be called perfect in the sense that they make things what they are.

310

Ibid. 68.5 (*On* 989a30)[1]

Next Aristotle brings up Anaxagoras, making light of his apparently explicit and clear statements, calling them absurd, and intimating that he must have really meant to say something else since what he did say turns out to be ridiculous. Aristotle improves Anaxagoras' formulations and spells out the true intent of his words, as he says he will do. He gathers from Anaxagoras' statement that all things are mixed in all things, that Anaxagoras had a fantastic picture of matter; for matter can become all things, but is actually none of the things it can become. Still, even though Anaxagoras does not say this clearly in his discussion of matter, it follows from his words—provided his theory is interpreted in the way he really would have wished to express these ideas; for put this way his theory is reasonable, while the apparently simple meaning of his words is completely absurd. Thus when Aristotle says "of course, it is absurd to say," he means that the absurdity of the statement that all things are in all things lies in the implication that they must have existed unmixed before they were mixed, since things which are mixed with one another must have been separate before they were mixed, so that the mixture can not have been the first thing to exist. The statement "all things are in all things" is absurd also because it is neither possible nor natural for something to be mixed with any other arbitrary entity, for how could a line be mixed with whiteness or whiteness with a musician? Furthermore, the statement is absurd because it implies that both the inherent and the accidental qualities of an object can be separated from the entire nature of the object and exist independently, since things which can be mixed can also be separated; and it follows that since these qualities are also in the mixture—for Anaxagoras says that all things are in the mixture—they can also be separated.

Although it is certainly absurd to say what Anaxagoras said . . . if his words were consistently reformulated and their meaning brought out, he would seem to be more of an innovator and more original than the other philosophers. The words "quite an original thinker" seem to have the same implication as Aristotle's statement in the beginning of the book that Anaxagoras was "earlier in age but after him in activity."[2]

Aristotle explains how Anaxagoras' words are to be reformulated in a consistent way; "before anything had been separated out," or actually had existed independently, it is clear that no existing predicate could have been applied to the nature of that thing, i.e. to the mixture Anaxagoras talks about, neither white, nor black, nor gray, nor any other color, nor any taste, nor any other similar predicate, and it would not be true to call it a quality or a quantity or any specific kind of real object. To specify it in this way would imply that some of the things in the so-called mixture were already separate and actually existed independently. This can not be, however, if all things were mixed together, because anything already separate would have been out of the mixture, whereas Anaxagoras asserts that all things were in the mixture except Mind, which alone is free from admixture and pure.

311

Ibid. 69.15 (*On* 989b16)[1]

Aristotle summarizes Anaxagoras' theory of basic elements as it would have stood had someone gone through it and reformulated his statements. According to Anaxagoras the basic elements of the universe are 'the one,' to which Mind, being simple, independent, and free from admixture, would be equivalent; and 'the other,' that is, undifferentiated matter, which is what matter was before it was differentiated and received properties: undifferentiated, i.e. nothing really, but containing everything potentially. This is the way Anaxagoras conceived the mixture to be, though "these things are not stated explicitly or clearly." However, even if he had said what Aristotle in his reconstruction says he meant, he would not have been altogether right, because he would be using only two basic elements in his theory instead of four. In addition it is not possible to say that Anaxagoras really meant all this, for he seems to have thought that the homoeomeries were actually in the mixture, not potentially there. On the other hand, Anaxagoras never expressed himself clearly.

312

Ibid. 97.12 (*On* 991a8)[1]

Aristotle sets down the names of those who held that each thing is what it is because it contains something else which makes it what it is. Anaxagoras said that everything is composed of all the homoeomeries, and the component present in greatest quantity in each thing imparts its outward appearance to the substance which makes up the object. Thus each thing is what it is because it is a mixture of other things . . . Aristotle says that the argument that each existing thing has its distinct properties by virtue of having something else contained in it is refuted with great ease, and he has provided a general demonstration that this is not the nature of existing things, in his argument against Anaxagoras.[2] He said there that it is not the nature of everything to be mixed with everything, because one can only mix things which can exist separately and independently, and qualities can not so exist. Moreover, since that which is mixed can also be separated, it would be possible, according to Anaxagoras, to separate qualities from objects. People who adhere to this view also deny the existence of physical change and hold all the other opinions Aristotle has argued against in his discussion of this theory in the first book of the *Physics*.[3]

313

Ibid. 134.22 (*On* 993a11)

. . . some, like Anaxagoras and Empedocles who assumed that there exists in addition to matter a factor which brings about physical change, held that there are two or three elements which must be taken into account in explaining anything.

314

Ibid. 136.5 (*On* 993a24)

Indeed above, when Aristotle was talking about Anaxagoras and formulating his theory in clear terms, he said Anaxagoras had not expressed his theories clearly but that they make sense when someone else sets them forth . . .[1]

315

Ibid. 291.15 (*On* 1007b18)[1]

Aristotle says that Anaxagoras' dictum "all things together" can apply in this way. According to Anaxagoras all things are really mixed in all things, so that nothing exists in a pure state, nor does any object really possess the distinct properties predicated of it . . .

316

Ibid. 291.20 (*On* 1007b26)[1]

Aristotle has said that for those who held that contradictory predicates can apply simultaneously to one object it follows that each existing thing is all things, so that for them Anaxagoras' doctrine that all things are together is valid . . .

He has spoken about Anaxagoras' theory in the first book where he says that Anaxagoras' statement that all is in all shows that he had a fantastic picture of matter as actually containing all things.

317

Ibid. 303.29 (*On* 1009a6)

Anaxagoras said that all things are mixed in all things, because he saw all things coming to be from all things.

318

Ibid. 307.3 (*On* 1009b12)[1]

To show that Anaxagoras too held this opinion,[2] Aristotle quotes a certain remark of his as a statement he once made to his friends, which had been preserved. Indeed, the statement that for each person things are as they appear to him to be is characteristic of one who believes that every conjecture is true, and that things really are as they seem to be.

319

Ibid. 307.30 (*On* 1009b12)

Next Aristotle tries to explain the source of the erroneous belief that thought is no different from perception, which implies that every conjecture and every speculation is true—an opinion held by Protagoras, and, as Aristotle has shown, concurred in by Empedocles, Parmenides, Democritus, and Anaxagoras.

320

Ibid. 334.22 (*On* 1012a17)[1]

The reasoning which led some people to postulate something intermediate between negation and affirmation is the following: Nothing can come out of that which does not exist; yet, contradictory qualities are seen to arise in one and the same object. It would seem then that these qualities were actually in the object as the components of a mixture are in a mixture. Now, a mixture is not identical to any one of its components, but its nature lies somewhere between them all, just as watered wine neither is, nor is not, water. Anaxagoras was among those who followed this line of reasoning.

321

Ibid. 336.15 (*On* 1012a21)[1]

Anaxagoras says that the properties of any object lie between the extremes of contrasting qualities, for the mixture is made up of perfect components as well as completely defective ones, and so is neither perfect nor, again, not perfect, and in the same way neither completely and utterly defective nor, again, not completely and utterly defective. Thus Anaxagoras holds that the properties of any object lie between the extremes of contrasting qualities, and all predicates—i.e. any property as well as its negation—are false. Aristotle says that if perfect components are mixed with defective ones the resulting mixture will be neither perfect nor not perfect, and neither completely defective nor not completely defective, but it will be a mixture having all these properties. Anaxagoras thought all things were mixed in all things, so that any predicate applied to any existing thing would be false.

322

Ibid. 336.25 (*On* 1012a29)

Aristotle has shown that negations and affirmations are simultaneously false according to Anaxagoras . . . "Some people say nothing is true" refers to people like Anaxagoras.

323

Ibid. 338.20 (*On* 1012a29)

Aristotle has shown that on Anaxagoras' premises the same absurd conclusion follows,[1] because for Anaxagoras all things are mixed, and a mixture neither is nor is not any one of its components.

324

Ibid. 339.16 (*On* 1012b8)

. . . all things are true,[1] as Anaxagoras said, and believed as well . . .

325

Ibid. 340.16 (*On* 1012b11)

This objection holds against . . . Anaxagoras, who says that all things are in all things and that thus no object is exclusively any of the things it is said to be.

326

Ibid. 461.33 (*On* 1028a31)

Those like Anaxagoras and Democritus who say that there exists an infinite number of fundamental entities hold also that there are an infinite number of things which truly exist.

327

Ibid. 630.12 (*On* 1056b28)[1]

It has been shown that 'few' is the opposite of 'many,' and 'many' of 'few,' and that 'few' in its simple sense means 'two.' Therefore, Aristotle says, Anaxagoras should not have said simply "all things in the universe were together, infinitely many and infinitely small," but he should have changed it and said "infinitely few." In this way he would not have had them infinite, for 'few' in its simplest sense is 'two,' and not 'one,' as some people say. 'One' is used in the sense of 'less than two,' and not in the sense of 'few,' since 'few' refers to more than one thing. Having interrupted himself to attack Anaxagoras for this, Aristotle returns to 'the one' and 'the many.'[2]

328

Ibid. 658.7 (*On* 1063b24)[1]

Aristotle sums up with the words "according to the theories of Heraclitus and Anaxagoras no statement can be true" . . . and we will not be able to make any true statements if we follow Anaxagoras . . . Aristotle explains how Anaxagoras could believe that contrasting qualities are in one object simultaneously: Anaxagoras held that all things—sweetness and bitterness, whiteness and blackness, and, in general, all things—are in each and every thing; for according to him all things are in all things actually, distinctly, and independently, not potentially. This, then, amounts to saying that contrasting qualities are in one and the same object.

329

Ibid. 673.4 (*On* 1069b15)[1]

Having thus disclosed that only matter undergoes change—by passing from a state in which it is devoid of specific properties to one in which it possesses specific properties and vice versa—Aristotle adds, "Anaxagoras' universal mass is a case in hand." According to Aristotle, by "the universal mixture" Anaxagoras means 'potentially.' We know this because Aristotle makes it quite clear that when Anaxagoras said that all things were together, that all things were one, and that Mind began at a certain time to separate them, he must have been indulging in fantasies about the nature of matter without understanding it. Moreover, Anaxagoras was not able to express himself clearly on the subject of matter. Accordingly, Aristotle says that it would be better to say that all things emerge from one thing which has the capacity to change into all things—and that it would be better to identify this one thing explicitly with matter—rather than to say that all things were together; for who can understand, when he hears "all things were together," that it is supposed to mean that matter is all things potentially? Anaxagoras then must have been indulging in fantasy about the nature of matter when he spoke of "all things were together," and he did not know what he was talking about.

330

Ibid. 674.16 (*On* 1069b26)[1]

Since, as we have said, one thing comes to be from one thing, another, from another, it was not enough for Anaxagoras to say that "all things were together," that is to say, that it is *matter* from which all things come. Rather he should have specified the *kind* of thing that comes from each *kind* of matter.

331

Ibid. 690.13 (*On* 1071b22)[1]

. . . and Anaxagoras really was referring to matter when he said that all things were together. Aristotle, however, is not attacking the physicists Empedocles and Anaxagoras here—for they said that the actual is prior to the potential, as he will go on to tell us; Empedocles said that what embodies the properties things actually have is Affinity and Repulsion, Anaxagoras, that it is Mind.

332

Ibid. 691.31 (*On* 1072a4)[1]

Aristotle asserts that the actual is prior to the potential and cites the theories of Anaxagoras and Empedocles as evidence. Anaxagoras said that the actual, i.e. Mind, is prior to the mixture . . .

333

Ibid. 716.32 (*On* 1075a11)

Aristotle is using "distinguished" to mean "created," just as Anaxagoras said that Mind created the universe by separating[1] the homoeomeries from one another.

334

Ibid. 718.21 (*On* 1075a34)[1]

Anaxagoras assumed that the source of all motion and change, or Mind, is the most perfect thing. However, since anything that brings about change impels things towards some final state, there must be some state towards which Mind is impelling things. Let them tell us what it is! However Aristotle says that perhaps Anaxagoras was talking the way we do when we say that healing—which in some sense embodies the state of being healthy—does anything it does to promote health with the aim of promoting itself. If therefore Anaxagoras meant that Mind is both that which brings about motion and change and that towards which things are impelled—so that all things which Mind impels are impelled towards Mind[2]—the argument would be reasonable.

Aristotle is bringing another complaint against Anaxagoras when he says that it is illogical for him to say that Mind is perfect without at the same time saying that there is something diametrically opposed to it, namely, something completely defective, because if one of a pair of contrasting qualities exists, the other must also exist.

335

Ibid. 821.27 (*On* 1091b4)[1]

Similarly, Empedocles, the Pythagoreans, and Anaxagoras say that that which is most excellent, i.e. that which is perfect, existed before all other things in the universe. Empedocles says that the most perfect and fundamental thing is Affinity . . . while Anaxagoras says it is Mind.

DIOGENES LAERTIUS

first half of the third century C.E.[1]

336

Biographies of Philosophers. Prologue 1.4

They say that Linus was the son of Hermes and of the Muse Urania. He wrote a poem about the creation of the world, about the courses of the sun and the moon, and about the creation of animals and plants. His work began: Once upon a time all things in the universe were together. This is where Anaxagoras got his statement that all things in the universe were together and that Mind then came and set them in order.

337

Ibid. Prologue 1.14

Anaximander was a pupil of Thales, Anaximenes of Anaximander, Anaxagoras of Anaximenes, Archelaus of Anaxagoras . . .

338

Ibid. Prologue 1.16

The philosophers who wrote only one book are Melissus, Parmenides, and Anaxagoras.

339

Ibid. Thales 1.42

Hermippus lists seventeen wise men in his book *Wise Men*. Different people select seven wise men from this list in different ways. The seventeen are: Solon, Thales, Pittacus, Bias, Chilon, Myson, Cleobulus, Periander, Anacharsis, Acusilaus, Epimenides, Leophantus, Pherecydes, Aristodemus, Pythagoras, Lasus the son of Charamantides or of Sisymbrinus (or Lasus of Hermione . . .), and Anaxagoras.

340

Ibid. Anaxagoras 2.6

Anaxagoras, the son of Hegesibulus—or perhaps of Eubulus—came from Clazomenae. He was a student of Anaximenes. He was the first to say that matter is controlled by Mind. His book, written in a lofty, pleasant style, opened in the following way: all things in the universe were together; then Mind came and set them in order. For this reason he was called 'Mind.' Timon says about him in his *Lampoons:* "Indeed they say that Anaxagoras, called 'Mind,'/ is a great hero, because his was the mind which suddenly woke up/ and wrapped into a neat bundle all things, which had previously been mixed up." He was noted for his lineage and his wealth, and also for his generosity because he gave away his patrimony to his relatives. For when they accused him of neglecting his property he answered back, "Why don't you look after it?" Finally he renounced everything and spent his time studying Nature, ignoring public affairs completely; indeed when someone asked him, "Aren't you interested in what happens to your country?" he pointed to the sky and replied, "Be still, I am greatly concerned about my fatherland."

He is said to have been twenty years old at the time of Xerxes' march, and to have lived seventy-two years. Apollodorus in his chronicle says that Anaxagoras was born in the seventieth Olympiad,[1] and that he died in the first year of the eighty-eighth.[2] He began to teach philosophy at Athens at the age of twenty when Callias was archon, as Demetrius of Phalerum notes in his list of archons. They say also that he stayed at Athens for thirty years.

Anaxagoras held that the sun is a red-hot mass of ore, larger than the Peloponnesus. Some people however say that Tantalus had said this earlier. Anaxagoras also said that the moon has habitations on it, as well as hills and gullies.

He said that homoeomeries are the primary building blocks of matter. The universe is made up of homoeomeries, which are small particles of matter, as gold is made up of so-called gold-dust. Anaxagoras held further that Mind is the source of all motion and change. Heavy matter occupies the lower regions of space, light matter, like heat, occupies the high altitudes, and liquids and gases occupy an intermediate position. Thus seas were formed on the earth, which is flat, when liquids were evaporated by the sun.

Anaxagoras said that originally the stars moved as in a dome, with the circumpolar constellations forming a cap over the earth. Later the stars assumed inclined orbits. He said that the Milky Way is caused by a deflection of the sun's light which prevents it from falling upon the stars of the Milky Way. Comets are conjunctions of planets which give off flame. He said that shooting stars are shaken out of the air like sparks; that winds arise when the sun's heat causes the air to become rarefied; and that thunder is the collision of clouds, lightning what is ejected from between the clouds. He also said that earthquakes occur when air sinks into the earth. He said that animals were created out of moisture, heat, and earthy matter, and that later, they reproduced from one another. Males come from the right, and females from the left.

They say that Anaxagoras predicted the fall of the stone which fell at Aegospotami inasmuch as he said a stone would fall from the sun. They say that Euripides, who was his pupil, said in the *Phaethon*,[3] on the basis of Anaxagoras' teaching, that the sun is a golden clod. They also tell that Anaxagoras came to Olympia and sat watching the games dressed in a leather coat, as if in anticipation of rain; and that rain subsequently fell. They say that to the question whether the sea would ever cover the mountains of Lampsacus he replied, "If time does not give out." When he was once asked for what purpose he had been born he said, "In order to observe the sun, the moon, and the sky." When somebody said to him, "You have been deprived of the company of the Athenians," he answered, "Say rather that they have been deprived of mine." When he saw the Mausoleum[4] he said, "An expensive tomb is the picture of wealth turned to stone." When someone was complaining that he was dying away from home, Anaxagoras said, "The road to the underworld is the same wherever you are."

According to Favorinus in the *Miscellaneous History,* it seems that Anaxagoras was the first to assert that Homer's poems deal with virtue and justice. Anaxagoras' pupil Metrodorus of Lampsacus maintained this position with greater vigor, and was also the first to study Homer's physical theories. Anaxagoras was the first to publish his writings as a book. Silenus says in the first book of his *History* that when Demylus was archon[5] a stone fell from the sky; and that Anaxagoras said that all the heavenly bodies are made of stone and that, having been set in place by an intense rotational motion, they would all fall down if the rotation let up.

Divergent accounts of Anaxagoras' trial are given. Sotion in *A Chronological Survey of Great Thinkers* says that he was arraigned by Cleon on a charge of impiety for saying that the sun is a red-hot mass of ore; and that since he was defended by his pupil Pericles, he was only fined five talents and sent into exile. Satyrus in the *Biographies* says the indictment was brought by Thucydides as a political step against Pericles; that Anaxagoras was accused not only of impiety, but also of having defected to the enemy during the Persian War; and that he was condemned to death *in absentia.* When the two reports reached him—of his condemnation and of the death of his sons—he said about the former, "Nature has long since condemned both the Athenians and me," and about the latter, "I knew that they were mortal when I begot them." Some people say that this was said by Solon, others say by Xenophon. Demetrius of Phalerum in his work on old age says that Anaxagoras buried his sons with his own hands.

Hermippus in the *Biographies* says that Anaxagoras was imprisoned prior to being executed, when Pericles came before the people and asked them whether they had any complaint concerning the conduct of his life; when they said they did not, he said, "But I am this man's pupil. Do not be misled by false accusations into killing him, but take my advice and set him free." Accordingly Anaxagoras was released, but he could not bear his degradation, and committed suicide. Hieronymus in the second book of his *Miscellaneous Notes* says that Anaxagoras was so debilitated and wasted by sickness when Pericles brought him before the court that he was acquitted out of pity rather than on the legal merits of his case. So much for his trial.

He seems to have been hostile to Democritus, since he was not willing to speak with him. At the close of his life Anaxagoras retired to Lampsacus where he died. When the rulers of that city asked what he wanted done on his behalf he requested them to give the children a vacation from school each year in the month of his death. This custom is maintained even today. When Anaxagoras died the people of Lampsacus gave him a fine funeral and inscribed on his tomb: "Here lies Anaxagoras, whose picture/of the order of the universe came closest to the truth." I too have written an epigram about him: "Anaxagoras once said the sun is a red-hot mass of ore,/and he was about to be put to death for it;/his friend Pericles saved him, but his/mind failed and he took his own life."

There have been three other Anaxagorases, none of whom talked about "all things." The first was a teacher of rhetoric, of the school of Isocrates. The second was a sculptor whom Antigonus mentions, and the other was a philologist, of the school of Zenodotus.

341

Ibid. Archelaus 2.16

Archelaus . . . was a pupil of Anaxagoras.

342

Ibid. Socrates 2.19

According to some people Socrates was a pupil of Anaxagoras, and also of Damon, as Alexander states in *The Transmission of Philosophical Doctrines*.[1] After Anaxagoras was condemned, Socrates studied with Archelaus.

343

Ibid. Socrates 2.35

When somebody said to Socrates, "The Athenians have condemned you to death," he said, "Nature has condemned them." Some people ascribe this reply to Anaxagoras.

344

Ibid. Socrates 2.45

Both Socrates and Euripides were students of Anaxagoras.[1]

345

Loc. Cit.

Plato, in *Socrates' Defense of Himself to the Athenians,* mentions Anaxagoras and certain other physicists whom Socrates rejected . . .[1]

346

Ibid. Socrates 2.46

A certain Antilochus of Lemnos and the soothsayer Antiphon opposed Socrates, as Aristotle says in the third book[1] of his work *On Poetry,* just as . . . Sosibius opposed Anaxagoras . . .

347

Ibid. Theophrastus 5.42

Theophrastus too has left a very large number of books. I thought it worthwhile to append a list of them because they cover all subjects. They are: . . . *Against Anaxagoras,* one book; *Concerning the Doctrines of Anaxagoras,* one book; . . .

348

Ibid. Empedocles 8.56

Alcidamas says in *The Physicist* that Zeno and Empedocles were students of Parmenides at the same time and that later each went his own way. Zeno taught philosophy on his own, while Empedocles became a pupil of Anaxagoras and Pythagoras, modelling his behavior after the dignified life and bearing of one, and his theories after the physical doctrines of the other.

349

Ibid. Xenophanes 9.20

Demetrius of Phalerum in his work *On Old Age,* and Panaetius the Stoic in his work *On Good Cheer,* both say that Xenophanes buried his sons with his own hands just as Anaxagoras did.

350

Ibid. Democritus 9.34

Later Democritus studied with Leucippus and also, according to some, with Anaxagoras, who was forty years older than he. Favorinus in his *Miscellaneous History* says that Democritus charged that Anaxagoras' theories about the sun and the moon were not his own, but ancient theories which he had plagiarized.[1] Favorinus further reports that Democritus attacked Anaxagoras' theories concerning the creation of the universe and concerning Mind, out of hatred for Anaxagoras, who had not accepted him as a pupil. If this is true, how could Democritus have been Anaxagoras' pupil, as some people maintain?

351

Ibid. Democritus 9.37

"If *The Lovers* is by Plato," Thrasylus says, "the unnamed character is Democritus—I mean the character mentioned in addition to Oenopides and Anaxagoras and their followers . . ."

352

Ibid. Democritus 9.41

Democritus was young, as he himself says in the abridged version of *The Creation of the Universe*, when Anaxagoras was old; indeed he was forty years younger than Anaxagoras.

353

Ibid. Diogenes of Apollonia 9.57

Diogenes the son of Apollothemis of Apollonia . . . was about the same age as Anaxagoras.

354

Ibid. Epicurus 10.12

Diocles says that Epicurus was influenced by Anaxagoras, and by Socrates' teacher Archelaus, more than by any other ancient philosophers, although on some points he disagrees with Anaxagoras.

LACTANTIUS

250–?317 C.E.

355

An Introduction to Theology (Institutiones Divinae) 1.5.18

Anaxagoras said that God is infinite Mind, which can direct its own actions.

356[1]

Ibid. 3.9.4

When Anaxagoras was asked for what purpose he had been born he answered, "in order to view the sky and the sun." Everyone admires this saying, and considers it worthy of a philosopher; but I think that Anaxagoras blurted it out merely to say something because he could not think of a good answer. Had he been wise he would have thought about the question and mulled it over; for if one does not know the reason for his existence he does not deserve the name 'man.' Certainly then the saying Anaxagoras came out with could not have been his considered opinion.

Let us see how many times Anaxagoras goes astray in this one short phrase, and how great his errors are. First of all, he implies that man's distinctive functions are performed by the eyes, thus leaving nothing to the mind, and attributing everything to the body. If Anaxagoras had gone blind, would he have lost his claim to be human? Certainly not, as long as his soul remained intact. And what about the rest of the parts of the body? Are their functions all dispensable? Are not the ears more important than the eyes? Surely learning and wisdom can be imbibed through the ears alone, but not through unaided eyes!

Were you born for the sake of seeing the sky and the sun? Who gave you this spectacle to look at? Does your act of perception in any way affect the sky or the physical universe? It is no wonder that you praise this immense, wonderful work; but confess then that God is the Creator of all things, and that He has brought you into this world to bear witness to His great works and to praise them. Do you believe that it is a great thing to see the sky and the sun? Why then do you not give thanks to Him Who has bestowed upon you this favor? Why do you not calculate in your mind the excellence, providence, and power of Him Whose work you admire? Certainly He Who makes these marvels must be even more marvelous than His creations. If you had been invited to dinner, and had accepted with great joy, would you not seem mad if you valued the pleasure you gained above the man who afforded you this pleasure?

We see then that philosophers ascribe everything to the body and nothing to the mind, and that they see no more than strikes their eyes. We, on the other hand, must disregard all the bodily functions and identify man with nothing else than mind. We see then that we are not born in order to observe created things, but in order to contemplate the Creator of all things Himself, that is, in order to perceive Him through the mind.

Therefore if anybody asks a *truly* wise man why he was born he will answer fearlessly and readily that he was born for the sake of worshipping God, Who has created us in order that we may serve Him—and the service of God is nothing else than the safekeeping and preservation of righteousness through good deeds. But Anaxagoras, like a man who has never experienced the divine Presence, lowered the greatest things to the level of the least when he said that there are only two things which one must view. Indeed, even if he had said that he had been born in order to view the whole world, thus encompassing all things and giving his words a grander ring, he would still not have been speaking of the activity distinctive of man; for, as the soul is greater than the body, so God, the Creator and Ruler of the world, is greater than the world. Therefore one should not say that the world must be contemplated with the mind, since it is *God* who is eternal and the soul too is eternal by His wish. Moreover when we contemplate God, we venerate and worship the Parent of the entire human race.

Since all this was far from the philosophers, and since they were earthbound in their ignorance of the divine, it is clear that Anaxagoras did not really see either of the things he said he was born to observe, either the sky or the sun.

357

Ibid. 3.12.20

As Anaxagoras saw, the contemplation of the sky and of light itself is so precious that it is worth suffering anything at all on its behalf.[1]

358

Ibid. 3.23.11

The others are just as crazy; for what else can we call the man who said that snow is black? How consistent was he? Did he also say that pitch was white? The same man said that he was born in order to observe the sky and the sun. Yet he saw nothing on earth, even when the sun was shining!

359

Ibid. 3.28.11

Whenever philosophers fail to explain something—and they fail in every field they study—they suddenly remember their ignorance, and like men gone mad, they jump up and cry out that they are blind fools. Thus, Anaxagoras proclaims that all things are covered with darkness . . .

360

Ibid. 3.30.6

Are we to wait around until Socrates finally learns something, or until Anaxagoras finds a light in the darkness . . . ?[1]

361

Ibid. 5.3.23

O! blind heart, O! mind blacker than the Cimmerian night (as they say)! You could be a pupil of Anaxagoras, for whom snow was black as ink![1]

362

Ibid. 6.1

The one duty of man, the loftiest thing of all, the most complete happiness in life, the thing for which we are fashioned and given breath by God, is not to view the sky and the sun, as Anaxagoras thought, but to worship the Creator of the sun and the sky . . .

363

Abridgement of AN INTRODUCTION TO THEOLOGY (*Epitome* DIVINARUM INSTITUTIONUM) 34.2

. . . Anaxagoras' statement that snow is black is more tolerable madness . . .

364

Ibid. 35.3

Anaxagoras asserted that everything is covered with darkness.

IAMBLICHUS

C. 250–C. 325 C.E.

365

Exhortation to Study Philosophy (Protrepticus) 8

"Our mind is God," as Hermotimus, perhaps, or else Anaxagoras,[1] said . . .

366

Ibid. 9

They say that when Anaxagoras was asked why a man should choose to be born, and what he should live for, he answered, "For the sake of observing the heavens, and the stars, moon, and sun moving in them"—as if all other things were worthless.

EUSEBIUS

?260–?340 C.E.

367

The Path to the Gospel (Praeparatio Evangelica) 1.8

. . . I shall show that Anaxagoras is said to be the first of the Greeks to have said that Mind is in charge of fashioning the universe.

368

Ibid. 8.7

Josephus writes much the same[1] in the second book of his work on the history of the Jews.[2] He writes the following: Moses taught all of us to look to God as the source of all good, of the blessings all men share as well as of the special benefits granted us in answer to our prayers in times of tribulation. And he asserted that God is uncreated, eternally unchanging, surpassing any human conception of perfection, revealed to man through His power, but unknowable to man in His nature and identity.

This is not the place to speak of the fact that the wisest men of the Greeks learned to conceive of God in this way according to these basic concepts set forth by Moses. Suffice it to say that they have borne abundant witness to the fact that these attributes are perfect, and appropriate to God's majesty. For Pythagoras, Anaxagoras, Plato, the Stoic philosophers after him, and indeed almost all the philosophers seem to have had this conception of God.

369

Ibid. 10.14

Anaxagoras, the son of Hegesibulus of Clazomenae, was Anaximenes' pupil. He was the first to formulate a clear account of the basic elements of natural philosophy. For he spoke not only of the matter of which all things are made, as had those before him, but also of the factor which imparts motion and change to matter; he says: In the beginning things were mixed together, and then Mind came and introduced order into their disorder. Anaxagoras had three students, Pericles, Archelaus, and Euripides . . . Archelaus took over the school of Anaxagoras in Lampsacus . . . The physicists Xenophanes and Pythagoras were in their prime at the same time as Anaxagoras was.

370[1]

Ibid. 11.2

It is well known that Thales, Anaximenes, and Anaxagoras, and their schools, and other contemporaries of theirs, devoted all their time to the investigation of nature.

371

Ibid. 14.11

> [Eusebius quotes in full the Xenophon passage brought in source 14 as the last part of a long quotation from Xenophon's *Memories of Socrates.*]

372

Ibid. 14.14

It is no other than Anaxagoras who is said to be the first of the Greeks to have asserted in his discussion of basic concepts that Mind is responsible for all things. At any rate, it is said that his devotion to natural philosophy was much greater than that of anyone before him; it is a fact that he allowed sheep to graze freely on his fields because he was so devoted to natural philosophy, and he was the first of the Greeks to formulate a clear account of the basic elements of natural philosophy. For he spoke not only of the matter of which all things are made, as had those before him, but also of the factor which imparts motion and change to matter; he says: In the beginning things were mixed together, and then Mind came and introduced order into their disorder. It is amazing that, though he was the first of the Greeks to speak about God in this way, he seemed to the Athenians to be godless because he did not refer to the sun but to its Maker as a god. Indeed he barely escaped being stoned to death. However it is said that even he was not consistent; for though he said that Mind is in control of all things he did not use Mind or reason to explain the physical behavior of existing things. Let us turn then to the charges Socrates brings against the man in Plato's work on life:[1] . . .

These are Socrates' remarks about the theories of Anaxagoras. Archelaus was Anaxagoras' successor as the head of his school, and followed his philosophical doctrines . . . Xenophanes and Pythagoras reached their prime at the same time Anaxagoras did . . .

373

Ibid. 14.16

In addition to the philosophers he has just brought, Plutarch introduces Anaxagoras again, saying that he was the first to have had a proper understanding of God. He says the following:[1] Anaxagoras says that in the beginning, all matter was at rest and the Mind of God set it in order and fashioned all things out of it. . . . Both Anaxagoras and Plato are wrong to have involved God in human affairs, and to have said that He fashioned the world for the sake of man.

374

Loc. Cit.

These are the natural philosophers' contradictory and blasphemous theories concerning God. It has been established that Pythagoras and Anaxagoras, Plato and Socrates, and their schools, were the first of the natural philosophers to say that Mind and God are in control of the universe. They were mere neophytes, of course, if one considers that they lived during the time in which the last events in the history of the ancient Jewish kingdom are said to have taken place. Thus, the God of the universe was not known in remote antiquity to any of the Greeks or even to the extremely ancient peoples, like the Phoenicians and the Egyptians; for they introduced polytheistic superstitions. Anaxagoras and his school were the first of the Greeks to speak of God.

375

Ibid. 14.17

Xenophanes is said to have flourished at the same time as Pythagoras and Anaxagoras and their schools . . .

376

Ibid. 15.23[1]

Concerning the sun . . . Anaxagoras, Democritus, and Metrodorus say that the sun is a red-hot mass of ore or of stone.

377

Ibid. 15.24[1]

Concerning the size of the sun . . . Anaxagoras says that it is many times the size of the Peloponnesus.

378

Ibid. 15.26[1]

Concerning the moon . . . Anaxagoras and Democritus say that it is a fiery solid body with plains, mountains, and gullies on it.

379

Ibid. 15.30[1]

What are the planets and fixed stars made of? . . . Anaxagoras says that the surrounding aether is a burning hot substance whose intense whirling motion snatched up stones from the earth, set them on fire, and turned them into stars.

380

Ibid. 15.39[1]

What is the reason the world is inclined to the plane of the ecliptic? Diogenes and Anaxagoras say that after the world had been put together, and animals had already emerged from the earth, the world somehow inclined all by itself toward its southern part. Perhaps this was a result of Providence, working to the end that some parts of the world might be uninhabited and others inhabited, according to whether the climate is cold, hot, or temperate.

381

Ibid. 15.47[1]

Concerning the courses and motions of the heavenly bodies, Anaxagoras, Democritus, and Cleanthes say that all the heavenly bodies move from east to west.

382

Ibid. 15.52[1]

Concerning the reflection of light from the moon and the reason the moon seems to be composed of earthy matter . . . Anaxagoras says the reason is the unevenness of its composition, since it is both cold and earthy, that is, because there is murky substance mixed in it along with its fiery matter. This is the reason that this heavenly body is called 'the body which shines with false light.'

383

Ibid. 15.59[1]

Concerning the origin of the sea and why it is bitter . . . Anaxagoras says that the water in the marsh which initially covered the earth was heated by the sun during its daily circuits. Thereupon the stagnant waters were evaporated and the rest remained salty and bitter.

384

Ibid. 15.62

Thus Socrates was right when he said that some existing things are above us and others have nothing to do with us—since there are physical bodies above us in the sky, and the things which happen after death have nothing to do with us—and only human affairs are of any concern to us. With these words Socrates bade farewell to the physical investigations of Anaxagoras and Archelaus . . .

385

Chronological Tables (Chronici Canones) 70th Olympiad[1]

In the seventieth Olympiad the historian Hellanicus, the philosopher Democritus, Heraclitus (nicknamed 'the obscure'), and the physicist Anaxagoras all attained to fame.

386

Ibid. 80th Olympiad[1]

In the eightieth Olympiad Anaxagoras died, and Heraclitus attained to fame.[2]

CHALCIDIUS

probably first half of the fourth century C.E.

387

Commentary on Plato's TREATISE ON NATURAL PHILOSOPHY *(In Platonis* TIMAEUM *Commentarius)* 203

. . . Anaxagoras speaks of very small bodies all resembling one another which coalesce to form an aggregate . . .

388

Ibid. 266

Contemplation alone can lift men's minds up to the vaults of heaven. This is the reason for the answer Anaxagoras is reputed to have made when he was asked for what purpose he had been born: he motioned towards the heavens and pointed at the stars, and said, "To look at all this."

389

Ibid. 279

We must go on now to investigate the theories of those who deny that matter is created. Their conjectures, too, differ widely. Some say matter is composed of small particles and is therefore continuous. The existence of these small particles must be deduced theoretically since they cannot be perceived directly. They are joined to one another and oriented in a certain way; and they possess certain shapes. This is the theory of Democritus and Epicurus. Others, like Anaxagoras, say that the particles also possess qualities; he believes that all kinds of matter with all their qualities are present together in each kind.

SERVIUS

fourth century C.E.

390

Commentary on Vergil's AENEID *(In Vergilii* AENEIDEM *Commentarius)* On 4.625 *s.v.* ex ossibus

There shall arise an avenger from my bones: This agrees with Anaxagoras who says that there is homoeomereity, i.e. identity of parts, when objects are formed, e.g. homoeomereity of bone, of blood, and of marrow; for in procreation each type of matter moves from one place to another independently of the others. Lucretius says, "Next let us investigate the 'homoeomery' of Anaxagoras."[1]

JULIAN

332–363 C.E.

391

A Consolation Written to Himself on the Occasion of Good Sallust's Departure (Consolatio Ad Se Ipsum) Or. 8.245d

. . . Pericles went on an expedition to Samos without taking Anaxagoras along; and then to Euboea, bringing it to terms with the aid of advice given him by Anaxagoras before his departure, though he did not drag Anaxagoras' body along with him like just another piece of war gear! Still they say that the Athenians deprived Pericles, very much against his will, of the company of his teacher, though he tolerated this mindlessness on the part of his fellow citizens like a prudent man, temperately and mildly . . . One can easily imagine Pericles saying the following: ". . . Now my city commands me to part from Anaxagoras. I shall no longer see my best friend, for whose sake I hated night, which hid him from my view, and welcomed gratefully the light of day, which let me see him once again, whom

I loved most of all. But, . . . Pericles, . . . nature has breathed life into you and given you a mind with a memory which lets you see past events. . . . We will imprint images of one another on our minds so as never to lose sight of one another: I will see Anaxagoras at one time, and he will see me at another, and nothing can prevent us from seeing one another at the same time. . . ."

392

Letter to Themistius the Philosopher 264b

If we say . . . that only those who are in politics, who control multitudes and rule over hordes, are really happy, what are we to say about Socrates? You might say that Pythagoras and Democritus and Anaxagoras the Clazomenian were happy in a different way because they immersed themselves in abstract thought; but Socrates, who did not immerse himself in abstract thought, and who was content to deal with practical affairs, could not even control his wife and child!

LIBANIUS

314–393 C.E.

393

Oration 8: In Praise of the Emperor Julian (Panegyricus Imperatori Iuliano Consuli Dictus)

. . . Julian however . . . admired the kind of thing Anaxagoras did when he let the fields he had inherited lie fallow, and prepared instead the soil of his soul to bear fruit . . .

394

Rhetorical Exercise I: Socrates' Defense of Himself to the Athenians (Declamatio I: Apologia Socratis) 153

Then, men of Athens, let him recall your fury at the sophists, at Anaxagoras, at . . .

Anaxagoras was justly imprisoned, because he showed irreverence towards the sun and moon.

395

Ibid. 156

Even Anaxagoras' pupil Pericles, the son of Xanthippus, had to face the anger of his fellow citizens, although he was the most powerful man in the state, was given the honorary title 'son of Zeus,' and died surrounded with honors. However, Pericles was able to gain the release of his teacher and save him, when he had been imprisoned in order to be censured by the Athenian people and to be led to adopt a better way of life.

AMMIANUS MARCELLINUS

c. 330–after 390 C.E.

396

History of Rome (Res Gestae) 17.7.11

According to the theories among which Aristotle vacillates, and with which he struggles, earthquakes are caused either by water which wells up with great force in minute pockets in the earth, called *syringes* in Greek, or else, as Anaxagoras held, by the force of winds which go beneath the lower side of the earth. When these winds come up against the clogged, solid parts of the earth and find no place to break through, they swell and violently shake those parts of the earth under which they have insinuated themselves. This explains the common observation that we feel no breezes when there is an earthquake: they are caught in the farthest recesses of the earth.

397

Ibid. 22.8.5

. . . Aegospotamus, where Anaxagoras predicted stones would fall from the sky . . .

398

Ibid. 22.16.22

From Egyptian sources Anaxagoras learned to predict the fall of stones from the sky, and to predict earthquakes by handling mud from cisterns.

GREGORY OF NAZIANZUS

329–389 C.E.

399

First Oration Against the Emperor Julian (Contra Julianum I) 71

You praise . . . the well of Cleanthes, and the leather strap of Anaxagoras,[1] and the sadness of Heraclitus . . .

THEMISTIUS

317–?387 C.E.

400

A Speech on the Emperor Constantius (Orat. II: De Imperatore Constantio) 30B

Don't you perhaps think, rather, that the true philosopher is one who . . . is even more just than Anaxagoras—doing right even when it is in his power to do wrong?

401

A Speech on the Kind of Language a Philosopher Should Use (Orat. XXVI: Quomodo Philosopho Dicendum) 317C

I need not mention Anaxagoras of Clazomenae and his radical innovation: he was the first who brought Mind and God into the creation of the universe and did not make everything depend on the intrinsic behavior of matter alone.

402

Ibid. 329C

. . . only Pericles and Aspasia received your praise[1] for being public speakers perfect in action and lofty in thought[2]—because they got this perfect action and lofty thinking from Anaxagoras' everyday conversation and added it to the art of rhetoric.

403

Commentary on Aristotle's PHYSICS *(In Aristotelis* PHYSICA *Paraphrasis)* 2.30 (*On* 184b15)

There are some, like Anaxagoras and Democritus, who posit in their theories an infinite number of building blocks of matter. Democritus however posits one kind of matter for all the atoms and differentiates them only by shape, while Anaxagoras says that contrasting qualities are in the homoeomeries, e.g. hotness and cold, whiteness and blackness.

404

Ibid. 13.19 (*On* 187a20)[1]

Anaximander does not hold that physical change is a process of qualitative change. Rather, he says that contrasting qualities exist already in the infinite extent of basic matter and become distinct when they emerge out of it. Others say this too, namely Anaxagoras and Empedocles, who assume that there are more than one basic kind of matter, in addition to one factor which fashions all things. Anaxagoras assumes the existence of homoeomeries and Mind; Empedocles assumes the existence of the four elementary kinds of matter and the Sphere. Furthermore these two, like Anaximander, do not say that physical change is a process of qualitative change, but that those things which seem to us to come to be emerge out of the mixture in which they previously existed. Empedocles however says this process stops and starts again periodically, while for Anaxagoras once it begins it never stops. Also, for the latter the elementary components of matter are infinite in number, while for the former they are the four. Two things seem to have led Anaxagoras to his opinion: one is his observation that objects change from a given state to a state having opposite properties. He thought that a given kind of matter cannot change into another, since in this way matter would be destroyed; therefore he concluded that opposite states exist in one another. Second and more important is the opinion shared by all physicists which led them to assume that something cannot come to be from nothing. That is why physicists say, "all things were always in the universe," and "all coming to be is a process of coalescence, and disappearance is a process of dissociation." Anaxagoras however says that physical change is qualitative change, but it is clear from the context that he did not understand the implications of his own words; for he *calls* coalescence qualitative change, but they are not the same.

In addition, Anaxagoras arrived at this opinion by employing the following syllogism: since all things come to be either out of things which already exist or out of nothing, and since they cannot come to be out of nothing, they must come to be from things which already exist. Thus it follows that all things already exist in anything from which something is said to come to be; for example, pieces of hair, bone, muscle, and flesh already exist in any volume of water, but they are imperceptible to us because they are so small. From this he concluded directly that everything is mixed in everything; for everything comes to be from everything. What then is the reason all things do not look alike, if everything comes to be out of everything in the same way? He answers that it is because everything is not in everything in equal amounts. Rather, in each object one kind of matter completely predominates and exceeds the others; e.g. in one object little pieces of water, and in another little pieces of flesh predominate. Therefore that which seems to be water presents that appearance because of the predominant component in it, since nothing can be purely water, flesh, or earth.

It is quite reasonable to examine the views of those who say that there are an infinite number of elementary building blocks of matter *after* the views of those who dispense with such building blocks altogether in their theory; for if the former too are refuted, then it must be acknowledged that the basic building blocks in any physical theory must be finite in number.

First of all, I am amazed that people who engaged to teach us about nature were unaware that they were making the comprehension of nature impossible. Since we assume that we understand something when we know its basic components and the conditions under which it exists, and since it is not possible to comprehend anything infinite, anyone who says that there are an infinite number of elementary components makes it impossible to know anything. If Anaxagoras meant that their number is infinite, but that they are limited in their variety, it would be impossible to tell how many parts each one is made up of, though it would be easy to specify the nature of the parts. As it is however, since he does not denumerate either the varieties *or* the number of the homoeomeries, he is being dishonest; for he gave us the impression that he would impart to us knowledge which he never claimed to have at the outset. This whole argument however is not really connected to what follows.

It *is* relevant however to know how Anaxagoras can avoid the absurdity involved in saying that the reason all things can be mixed in all things is that each of the homoeomeries can be infinitely large or small, so that it is impossible to find either a smallest or a largest. It is clear from the following argument that he cannot: it is generally acknowledged that every composite body is made up of parts, and I mean by 'parts' the kind of parts which can actually be separated from one another and from the whole. It is also clear that the size of the whole is directly dependent upon the size of the parts; for example, if the parts are small the whole will be small, if they are large it will be large, and if they can become infinitely large or small, then so can the bodies they compose. Indeed, if flesh, muscle, and bone can be of any size, so can an animal; and if the parts of a plant can be, so surely can a plant. The opposite is true too in the same way: if the whole can not be of arbitrary size, neither can the parts. Now even according to Anaxagoras animals and plants are limited in size. Therefore the sizes of their parts too must be limited and it must be impossible for a piece of human flesh to be of arbitrary size. Thus it is impossible for the flesh which exists in a grain of millet, together with myriads of other things, to keep on getting smaller and still be flesh. That would be absurd.

Perhaps Anaxagoras would answer these arguments as follows: I do not admit that the variations in size among animals and plants correspond to variations in the size of the homoeomeries. This would necessarily be so if animals and plants each contained only *one* indivisible homoeomerous piece of each kind of homoeomerous matter, i.e., *one* of bone, *one* of blood, and similarly *one* of each of the others. As it is however, there are many pieces of each kind of homoeomerous matter in each species of animal, so that there is nothing at all absurd in saying that the size of a piece of flesh can become indefinitely small while the animal does not. For the flesh of an animal is made up of *many* particles of flesh as its basic building-blocks and elementary components.

However even though this is granted, these elementary components must still be finite in size; for Anaxagoras will certainly grant that only a finite number of elementary components of flesh coalesce to make up the amount of flesh found in an animal. Let us assume that there are four or five such units. If each one of these units of flesh could be indefinitely small, the resulting piece of flesh made up of four units would be too small to compose the flesh of any animal.

Moreover what can it mean to say that human flesh is made up of many pieces of flesh? Why should not each of these pieces of flesh in turn be made up of many pieces of flesh, if we assume that the homoeomeries can be indefinitely subdivided? It is completely ridiculous too that the flesh of an elephant could be made up of fewer pieces of flesh than that of a gnat, since there would be no difference between saying that something is made up of more pieces or of fewer, if the size of the pieces is inherently unbounded in both directions.

All in all it is not possible for an infinitely small piece of flesh still to remain flesh. Just as it is impossible to imagine any body cut into infinitesimal sections, so it is impossible to imagine flesh so subdivided, for it will not be long before flesh will no longer exist. Anaxagoras will probably admit this, since according to him the basic building-blocks can not be destroyed. If what we have said is true and the size of the smallest piece of flesh is bounded, it follows that all things can not be mixed in each thing. Indeed consider what would happen if they were. Since every material object is of finite size, even if one should keep on removing the tiniest particles—which are still finite, of course—from a body, the process of removal would have to come to an end at some time. Consider an actual example. If one kept on taking flesh out of a given volume of water, the flesh that was in the water would certainly give out; for it is not possible to prolong the process indefinitely, since the tiniest piece of flesh is of finite size. Therefore one of two possibilities presents itself: either the process will stop and the remaining water will no longer have flesh mixed in it, or else the process will not cease and a finite magnitude—I mean the volume of the water—will contain an infinite number of pieces of flesh actually existing in it. However this would surely surpass any feat of magic.

In addition any body becomes smaller when something is taken away from it. Therefore since the size of a piece of flesh is bounded in both directions it is clear that nothing can be extracted from the smallest piece of flesh, for in that case there would be something smaller than the smallest piece.

How then can everything be in everything? Aren't we being small if we say this? If everything is in everything there will not only be flesh, but also blood, bone, and brain in the smallest piece of flesh; and again in each one of these—for example in the blood—there will again be flesh, blood, and bone; and in addition in the same way there will exist in each one of these everything else, and so on without end. Now is it not sheer nonsense for an infinite number of pieces of flesh, water, earth, and air to exist in the smallest piece of flesh, especially since, as I said before, they must exist independent and distinct from one another? Indeed it is even more ridiculous than it seems; for if a thing is separate it must be finite, since things which are separate from one another are bounded in size as well as in place. According to him then the basic building blocks will be infinite both in number and in size, that is, they will be infinitely many times infinite.

If somebody said on Anaxagoras' behalf that the fundamental components are free from admixture inasmuch as they are fundamental, and that all things are mixed together only in perceptible, composite objects, let him apply the argument to such objects too, e.g., to a perceptible volume of water, where without doubt there will exist by a similar argument an infinite number of pieces of flesh and bone, distinct from one another, and each compounded of all things. These pieces too then will have to be perceptible, it will be possible to extract them, and consequently other things again will exist in each of them; for certainly they can never be separated into pure fundamental components, as Anaxagoras himself testified when he said that this is impossible. Why then should Mind be eager to do this? If it tries to do the impossible how can it be anything but mindless? However, Anaxagoras is correct, though by sheer accident, when he says that no separation of existing things can ever be complete. Attributes are not indeed separable from objects. What purpose then can the fruitless work of this clever Mind serve if Mind cannot separate the basic components quantitatively, because they are indefinitely subdivisible, or qualitatively, because attributes—for example, colors, states, and all the rest—cannot be separated from objects? Even Anaxagoras admits that Mind can not carry the first process to completion and we know that it can not do the second because it is self-evident.

Moreover, Anaxagoras was wrong to base his belief that flesh is made up of little pieces of flesh, and gold of little pieces of gold on the assumption that every homoeomerous object can be subdivided into smaller homoeomerous pieces, and on the assumption that since something is destroyed when it is taken apart, it comes to be when its parts are put together. These assumptions do not constitute sufficient evidence for this. For example, mud can be divided into pieces of mud, and also into water and earth. Which would you prefer as an explanation for the formation of mud? Is mud formed from little pieces of mud, or rather from earth and water? Or is it perhaps true that a piece of mud comes to be in one way and increases in size in the other? For example when liquid forms out of gas it is not formed by the coalescence of little pieces of liquid, the way a house is made when building-blocks are put together—but this is what these physicists mean by their fine process of composition! Rather we see that gas changes into liquid by undergoing qualitative change, which is what we mean when we say that liquid forms out of gas.

405

Ibid. 17.27 (*On* 188a18)

. . . they all say that contrasting qualities are basic . . . Anaxagoras says that contrasting qualities are in the homoeomeries . . .

406

Ibid. 21.9 (*On* 189a12)[1]

Empedocles gives a better account of physical change than Anaxagoras does, since he employs a finite number of elementary kinds of matter in his theory.

407

Ibid. 48.25 (*On* 196a17)[1]

Truly neither Empedocles nor Anaxagoras nor anyone else took any account at all of chance in their theories. They did not include chance among the factors they introduced to explain things—e.g., Affinity, Repulsion, Mind or Fire—nor did they think that it resembles any one of these factors . . .

408

Ibid. 59.11 (*On* 198b12)[1]

. . . those who spoke about a factor which fashions things merely touched on it and then let it go, as did Empedocles, Anaxagoras, and any of the other ancient thinkers who may have spoken of it.

409

Ibid. 80.31 (*On* 203a19)[1]

. . . all those who assumed that there is one infinitely extended basic kind of matter, as well as those who assumed that there is more than one—not finite in number but infinite—as did Anaxagoras, who spoke of infinite homoeomeries, and Democritus, who spoke of infinite shapes, held that the universe is infinite in size.

410

Ibid. 89.17 (*On* 205b1)[1]

Anaxagoras gives an absurd reason why the infinite mixture remains stationary and motionless. He says that it is contained in nothing else because it is infinite, and that it holds itself in place, leans on itself, and supports itself, so that the stationary state is proper to it.

411

Ibid. 123.7 (*On* 213a22)[1]

Anyone who seriously tries to oppose the belief that a void can exist should not set out to prove that the air is not a void. This is what Anaxagoras used to do when he twisted inflated wineskins and showed that air has pressure, or when he showed that water would not enter a water clock unless the air was given an outlet.

412

Ibid. 209.15 (*On* 250b24)[1]

. . . Anaxagoras says that all things coexisted in the universe for an infinite time, and that at a certain time Mind instituted order, motion, and change . . . so that, for Anaxagoras, motion and change, as well as the world, had a beginning and continue indefinitely.

413

Ibid. 212.23 (*On* 252a3)[1]

Anaxagoras does not explain why Mind was so tardy and started only at a certain time to introduce motion and change into this mixture, which had been at rest for infinite time. Why not earlier? And why not earlier again than that?

414

Ibid. 223.11 (*On* 256b24)[1]

Anaxagoras does well to say that Mind is not subject to change, because he assumes that it is the source of change.

415

Paraphrase of Aristotle's ASTRONOMY[1] *(In Libros*
Aristotelis DE CAELO *Paraphrasis)* 11.31

[Paraphrase of source 28]

416

Ibid. 85.18

[Paraphrase of source 29]

417

Ibid. 110.36

[Paraphrase of source 30]

418

Ibid. 111.30 (*On* 301a11)[1]

Anaxagoras and Empedocles prefer the natural to the unnatural and proceed from a prior natural state to an unnatural state which follows.[2] Anaxagoras says that Mind separated out the things which were in the stationary mixture.

419

Ibid. 117.27

Paraphrase of sources 31 and 32. The following is added at the end:

Aristotle's argument against Anaxagoras, in which he demonstrates the falsity of Anaxagoras' conclusions, could be given more simply by a *reductio ad absurdum* to show that the homoeomeries are not infinite in variety. Anaxagoras says that every material body is made up of all the homoeomeries. If then the homoeomeries were infinite in variety, it would turn out that any material object is actually made up of an infinite number of things. Now anything made of an infinite number of actual things must be infinitely large, so that in this way every material body would be infinitely large. This however is patently absurd. Therefore the homoeomeries are not infinite.

420

Ibid. 120.35 (*On* 303a17)

The first error Democritus and Leucippus make is the same as that made by Anaxagoras and his school; for it is possible to explain the same phenomena without assuming an infinite number of basic building blocks of matter . . . Aristotle then accuses them of another error. They do not understand that the material bodies which exist—what they call the universe—are not infinite in variety, so that the basic components—atoms or elementary kinds of matter—from which the material objects we see arise also can not be infinite in variety. This is what was said earlier concerning Anaxagoras' opinion.

421

Ibid. 122.11 (*On* 303a29)

Aristotle does not here refer explicitly to Anaxagoras' theory that the basic components of matter are infinite in number. He has said however that not even according to Leucippus and Democritus are the basic building blocks infinite in number—as he has explained—thus implying that the building blocks are not infinite in number according to others[1] either.

422

Ibid. 146.1

[Paraphrase of source 33]

423

Commentary on Aristotle's PSYCHOLOGY *(In Libros Aristotelis* DE ANIMA *Paraphrasis)* 9.3 (*On* 403b25)

Since the differences between a living thing and an inanimate thing are reducible primarily to self-propulsion and perception, the more ancient philosophers divide along these lines: some of them define life by means of motion, and others by means of perception. Democritus and Anaxagoras belong among the former, as perhaps does Plato too.

424

Ibid. 9.35 (*On* 404a25)[1]

Anaxagoras and the others who say that Mind is the source of motion in the universe hold that life is the factor which gives rise to motion. Democritus differs: he thinks that to have a mind and to have life are exactly the same thing since what appears to the senses—which includes the mind according to him—is really so. He assumes too that thought is the same as sense perception and he brings Homer as evidence; for Homer did well to tell of Hector lying there out of his mind when he was lying there senseless. Democritus does not treat the mind any differently than sense-perception; he does not associate it with the capacity for conceiving truth but he identifies the possession of mind with the ability to perceive, i.e. mind with life. Anaxagoras however is less clear. He says often that Mind is the factor responsible for the proper order of things, since he assumes that it is more divine than the rest of the life functions. Often however he confuses the two and identifies Mind with life, as when he maintains that all animals—large and small, honorable and base—possess Mind, thus calling sense-perception Mind; for sense-perception is a possession of almost all animals, while Mind in the sense of intelligence is not only not a possession of all animals, but perhaps not even of all men.

425

Ibid. 10.7 (*On* 404b1)[1]

Anaxagoras is less clear about these things: in many places he says that Mind, because it is more divine than other manifestations of life, is responsible for order, but in many places he shows confusion and equates Mind with life, as when he assumes that Mind exists in all animals, large and small, honorable and base. Here he might mean 'perception' when he says 'Mind,' for almost all the animals have that. However all animals alike do not have Mind in the sense of intelligence, and perhaps even the majority of men do not.

426

Ibid. 13.14 (*On* 405a13)[1]

Anaxagoras, as we have said above, is not at all clear as to whether he takes Mind and life to be identical or different. However he does say that Mind is responsible for the disposition of almost all existing things. He calls it simple and free from admixture, and subordinates the homoeomeries to it in the role of matter. At any rate he thinks that both perception and motion are necessary to life. He says very clearly that motion is necessary: "All things in the universe were together; then Mind came and separated them." Perception and knowledge are also necessary, being characteristic of Mind.

427

Ibid. 14.10 (*On* 405b19)[1]

Anaxagoras is the only one who dispenses with any similarity between life and matter. He agrees that all things can be known by a living being and he says that Mind is completely free from admixture and simple, and that it resembles nothing which it perceives. However he does not himself say, nor is it clear from his writings, what it is that enables it to perceive.

428

Ibid. 35.9 (*On* 410b24)

. . . if one were to agree with Anaxagoras and say that Mind exists in every living being, and that it is part of the nature of life, and that every living being possesses all the possible attributes of life . . . one would still not be speaking about all the characteristics of life . . .

429

Ibid. 94.20 (*On* 429a18)[1]

. . . Anaxagoras was not engaging in wild fantasy when he said that Mind is free from admixture and inherently different from everything it knows.[2] Certainly the easiest way for it to know would be for it to be made of no kind of matter specific to itself. For any property it might have would impede and block its perception of other kinds of things, since they would be different from it.[3]

430

Ibid. 97.8 (*On* 429b22)[1]

Anaxagoras was partly right in what he said about Mind, and partly wrong. He was right when he said that Mind is free from any admixture of matter, but he was wrong in omitting to tell us how it can think all things if this is its nature, since thinking involves interaction. Now nothing immaterial can be acted upon; rather there must be some matter common to both the interacting objects.[2] For this reason one thing cannot interact with any other arbitrary thing—for example, a line with noise—but only things which have some kind of matter in common can interact. Anaxagoras did not discern this . . .

NEMESIUS

fl. c. 390 C.E.

431

Essay On Man (De Natura Hominis) 313a

If all men looked exactly alike, all things would certainly be mixed up, as Anaxagoras says.

JEROME

c. 348–420 C.E.

432

Letter to Heliodorus (Epistula 60) 5

Where are the humanistic studies of my youth? Where is the oft-quoted saying of Anaxagoras and Telamon, "I knew that I begot a mortal?"

MARTIANUS CAPELLA

wrote between 410 and 429 C.E.

433

Book 6. On Geometry (De Geometria) 589

Then Geometry will answer that the earth is not flat, as they who compare it to a vast disc say; nor concave, as is maintained by those who say that rain falls into the lap of the Earth; but Dicaearchus asserts that it is spherical, like a globe, as Secundus[1] tells us. Indeed the risings and settings of the constellations would not vary according to the observer's elevation and latitude if they rose at one time over the entire expanse of land and sea, as would happen if the earth were flat and all things were laid out flat on it; nor would they vary even if the risings of the sun were hidden from view behind the raised edges of a concave earth. The latter theory is more absurd than the former, and it is vitiated because it is based on a worthless, unfounded conjecture. Accordingly it is more profitable to examine the first theory, which even the physicist Anaxagoras held—though indeed he is believed to have provided some proofs for it. He says that the fact that the earth is flat is clearly proved by the risings and settings of the sun or of the moon, which come into view immediately as soon as the first rays emerge and travel in a straight line to the eye. This phenomenon is even more striking as proof if we leave the mountainous regions where our view is blocked and stand on the seashore. However, if this were so, the sun and moon would appear to everybody on earth at the same time and all the earth would be cast into darkness at one stroke when they set . . .

AUGUSTINE

354–430 C.E.

434

The City of God (De Civitate Dei) 8.2

However Anaxagoras, who was Anaximenes' pupil, realized that divine Mind fashions everything we see. He said that Mind made all things out of infinitely extended matter consisting of particles similar to one another which came from all substances; each individual object is made of those particles which properly belong to it and divine Mind is that which makes each object . . . Archelaus, Anaxagoras' pupil, succeeded to his place. He too believed that all things are made up of particles similar to one another which compose each and every thing, and that each thing is composed in such a way as to show that divine Mind resides in all things and makes everything happen by means of the combination and dissociation of indestructible matter, i.e. these particles.

435

Ibid. 18.41

Can any founder of a sect gain such supremacy in this demonic city[1] that no support can be found for those who dissent and oppose his opinions? . . . I find it hard to believe that Anaxagoras was prosecuted on a charge of atheism because he said the sun was a flaming stone, though Epicurus flourished in the same city . . .

436

A Refutation of Julian, the Pelagian (Contra Julianum) 4.15.75

Who can read your works and fail to see that you are only trying to show off your pretended erudition by mentioning the names of learned men and different schools of thought, since it is evident that these things have no bearing on the question between us? For who can hear you mention "Thales of Miletus, one of the Seven Wise Men, Anaximander, Anaximenes, Anaxagoras, Xenophanes, Parmenides, Leucippus, Democritus, Empedocles, Heraclitus, Melissus, the Pythagoreans" each one with his particular physical theory . . . and not be terrified . . . ? . . . Why, then, to give only one example, did you leave out Anaximenes' other disciple, Diogenes, when you mentioned Anaximenes and his pupil Anaxagoras?

437

Letter 118 (*Epistula* 118) 2.12

If you must learn about the mistakes of others, open up your eyes and perk up your ears to see and to hear whether anyone brings anything from Anaximenes or Anaxagoras against us . . . If one has to be armed with knowledge gained through the arduous study of teachings which conflict with the truth, let us at least turn to the heretics who call themselves Christians rather than to Anaxagoras or Democritus.

438

Ibid. 4.23

That most salutary humility which our Lord Jesus Christ displayed in his debasement as an example for us is in marked contrast to a certain kind of pride in useless learning; for what else is it when, for example, we are happy that we know the teachings of Anaximenes, Anaxagoras, Pythagoras, Democritus, and other such things, so that we may seem learned and cultured? Such things however are far from the truth. For he who taught that God has no extension and is not greater in one place and smaller in another since He does not occupy any space, finite or infinite, being entirely present in every place just as Truth is[1]—for no one who is sober[2] will ever say that some Truth is in one place and some in another; and God is Truth, as it were—will never convince the other fellow—whoever it was—who taught that God is infinitely extended gaseous matter . . . If Anaxagoras, or whoever it is, says Mind is Truth and Wisdom personified, why quibble about words? It is clear that all things are given their individuality and their proper measure[3] by Mind, and also that it is not unfitting to call Mind infinite—not spatially infinite, but of boundless power, incomprehensible to human thought. This does not mean that Wisdom itself has no properties; for it is a property of infinite *bodies* to have none: *bodies* which are infinite have no properties.

Cicero, in his eagerness to refute Anaxagoras, it seems, argues against him as if he holds that all things are material. On the grounds that a body must be bounded at the place where something is in direct physical contact with it, Cicero denies that anything can be in direct physical contact with infinity, writing, "He did not realize that there is no such thing as motion brought about by direct physical contact," that is, by continuous coupling and adhesion, "with an infinite source of motion," that is, with an infinitely extended object—as if he is dealing with material bodies, with which nothing can be in direct physical contact unless they are spatially bounded. Similarly he adds, "or that perception would be entirely out of the question in his theory, unless nature as a whole perceived every stimulus"—as if Anaxagoras meant that Mind, which orders and governs all things, perceives all things the same way a living being does: through the body! Now it is true that a living being in its entirety perceives anything perceived through the body; for certainly the entire living being, as it were, is conscious of what it is that is perceived. But Cicero's aim in saying that all of Nature must be a sentient being is, so to speak, to refute Anaxagoras' doctrine that Mind is infinite; for, he argues, how can Mind as a whole perceive if it is infinite? For sensation begins at some point in a body and does not pervade the whole body until it has reached its extremities; but this cannot be said about the infinite. Anaxagoras however was not talking about bodily sensation; and something incorporeal can be called a whole in a different sense than can a material object, for everybody understands that something incorporeal has no spatial boundaries and so can be called 'whole' and 'infinite' at the same time: 'whole,' because of its inherent unity, and 'infinite,' because it is not spatially bounded.

"Further," he says, "if he meant to say that Mind is itself, as it were, a living being, there must be something within it which qualifies it to be called a living being," and so that Mind of yours must be like a body and must contain life within it, which would allow it properly to be called a living being. Notice how far Cicero goes in using terms drawn from the material world as he argues from the animate world. Surely he does this because of the coarseness of his opponents' observations![4] Still he has said something which would certainly catch his opponents' attention if they could rise from the dead; namely, that it is preferable to say that everything connected with life—for example, a living body—possesses life and is a living being, rather than to think that it is simply life itself. This is what he means when he says: "There must be something within it which qualifies it to be called a living being." And he adds: "What can lie within Mind?" in order to show that Mind cannot contain life within it to qualify it to be a living being, because Mind itself is innermost in a living being. This is what he means when he says, "Is it then to be bounded by an external body?"—as if Anaxagoras would ever say that Mind cannot exist unless it belongs to a living being! For Anaxagoras taught that Mind itself is the highest Wisdom, Which belongs to no single living being, since Truth is at hand to embrace all souls and give them all strength. Cicero concludes quite wittily. "This too is surely unacceptable," he says, meaning that it cannot have been Anaxagoras' opinion that Mind, which he calls God, is bounded by an external body, and is thus a living being. "It seems therefore that plain, simple Mind with nothing added to it by which it can perceive"—that is, with no body along with it through which it can perceive—"is beyond the power of the mind to conceive." Certainly it seems to be beyond the power of the minds of the Stoics and the Epicureans,[5] who cannot conceive anything but physical objects. When Cicero says "our mind" he means "the human mind"; he was right, moreover, not to say "is beyond," but "seems to be beyond"; for to the Stoics and the Epicureans it seems that nobody can understand this and therefore they think that it does not exist at all. However this concept is not beyond the power of certain people's minds, at least in so far as a human being is able to understand that there exist plain and simple Wisdom and Truth which belong to no single living being, but enable every living being which can know them to become wise and truthful. Still, even though Anaxagoras perceived the existence of this Wisdom, saw that it is God, and called it Mind, this fact is of no use. We will certainly not become learned and wise through the name of Anaxagoras, which all the literarions, to use military jargon,[6] love to bark out because of its antiquity in literature; and we will not even become learned and wise through the knowledge which led Anaxagoras to acknowledge this truth. The truth must be clear to me not because it was obvious to Anaxagoras, but because it is true, even if no philosopher discovered it.

CYRIL OF ALEXANDRIA

376–444 C.E.

439

A Refutation of Julian (Contra Julianum) 1B13

They say that Democritus and Anaxagoras, the natural philosophers, as well as Heraclitus . . . lived in the seventieth Olympiad.[1]

440

Ibid. 6B189

Anaxagoras was tried at Athens and condemned to death, because he said that the sun's disk is a fiery stone.

SYRIANUS

c. 380–*c.* 450 C.E.

441

Commentary on Aristotle's FOUNDATIONS OF SCIENTIFIC THOUGHT *(Commentarius in* METAPHYSICA*)* 70.38 (*On* 1007b22)[1]

How then are they[2] led to this opinion? If they hold Protagoras' doctrine, that whatever seems to anyone to exist does exist, they are naturally led to say that all things are in all things, so that Anaxagoras' dictum "all things together" must apply for them . . . Again, if they hold that two contrasting predicates always apply to any object if one of them does—though not that all predicates need apply to every object—. . . once again Anaxagoras' dictum "all things together" must apply for them. Indeed he too said it because of the fantastic conception he had of matter.

442

Ibid. 75.29 (*On* 1009b26)[1]

Aristotle mentions a certain saying of Anaxagoras that for each of us reality accords with our disposition at any given time.

443

Ibid. 78.35 (*On* 1011a19)

. . . Therefore it is not true either that all things are true or that all things are false. It is not clear whether Anaxagoras or Heraclitus or someone else first said these things.

444

Ibid. 117.3 (*On* 1079b20)[1]

. . . Anaxagoras' theories concerning the homoeomeries and Eudoxus' theories about the same sort of things are easily overthrown . . .

THEODORETUS

c. 386–at least 457 C.E.

445

An Antidote to Greek Culture (Graecarum Affectionum Curatio) 1.97

. . . There was a great controversy among them concerning the sun. Anaximander and Anaximenes said that it is twenty-seven times the size of the earth; Anaxagoras said that it is larger than the Peloponnesus; . . .

446

Ibid. 2.22

Those who bear witness to the truth speak in one way, but the truth expresses itself in another. Among those who bore witness to the truth were the following:

Anaxagoras the son of Hegesibulus of Clazomenae. The philosophers before him could not carry their thoughts beyond perceptible phenomena, but he was the first to say that Mind controls the world, and that it brought the basic kinds of matter into order out of disorder.

Pythagoras the son of Mnesarchus. He said that the basic element in all things is the number one. Anaxagoras and Pythagoras were contemporaries of his.

. . . Archelaus took over the school of Anaxagoras, and Socrates the Athenian took over the school of Archelaus. Anaxagoras and Pythagoras went to Egypt, and conversed with the learned men among the Egyptians and the Hebrews there, thus acquiring knowledge about everything that exists . . . In this way Pythagoras, Anaxagoras, and Plato learned many surprising things about the world around them from the Egyptians and the Hebrews.

447

Ibid. 2.50

According to Porphyry, Moses lived more than a thousand years before . . . the most ancient of the poets; they in turn were much earlier than Homer and Hesiod, who lived many many years before Thales and the rest of the philosophers—while Thales and his contemporaries lived many many years before the next generation of philosophers after theirs.

Oughtn't we then forget about all of them and go back to Moses—that ocean of theology, "the source of all the rivers and all the seas,"[1] to use the poetic expression. Afterwards however Anaxagoras, Pythagoras, and Plato drew a few small glimmers of truth from this source;

and from these rivers and seas Socrates, the pupil of Anaxagoras and Archelaus, learned everything he later taught concerning existing things.

448

Ibid. 2.116

It is time, my friends, to follow the path of truth. Just as people who dig for gold or silver find nuggets, follow their track, and discover whole veins of ore, not ceasing to dig until they have found the great mass of gold from which the scattered nuggets came, so too you must listen to Anaxagoras, Pythagoras, and Plato—and to Numenius, Plutarch, Plotinus, and others as well—and go on to search for the source of divine waters from which they drew a few drops to compose their works.

449

Ibid. 4.13

Thales, Pythagoras, Anaxagoras, Heraclitus, and the whole crowd of Stoics said that matter is subject to change, undergoes qualitative transformations, and is in flux.

450

Ibid. 4.15

Thales, Pythagoras, Anaxagoras, Parmenides, Melissus, Heraclitus, Plato, Aristotle, and Zeno agree that there is one world; Anaximander, Anaximenes, Archelaus, Xenophanes, Diogenes, Leucippus, Democritus, and Epicurus say that there exist more than one, and indeed that there are an infinite number of worlds.

451

Ibid. 4.17[1]

Anaxagoras says that stones are pulled up by the rotation of the universe, and are called stars after they have burst into flame and have become fixed in the heavens.

452

Ibid. 4.21[1]

Anaxagoras, Democritus, and Metrodorus say that the sun is a red-hot mass of ore or of stone.

453

Ibid. 4.22[1]

Anaxagoras says that the sun is larger than the Peloponnesus.

454

Ibid. 4.23[1]

Anaxagoras and Democritus say that the moon is a fiery solid body with plains, mountains, and gullies on it.

455

Ibid. 4.26

[Theodoretus quotes the first sentence of the Xenophon passage brought in source 14.]

456

Ibid. 5.18

Anaximenes, Anaximander, Anaxagoras, and Archelaus say that life is made up of gaseous matter[1] . . . Pythagoras, Anaxagoras, Diogenes, Plato, Empedocles, and Xenocrates asserted that life is indestructible.[2]

457

Ibid. 5.45

Anaxagoras . . . rejected the theories of Anaximenes after his death.

458

Ibid. 6.15[1]

Anaxagoras, Democritus, and the philosophers of the Painted Stoa, as they are called, say that chance is a factor incomprehensible to human thought.

459

Ibid. 11.8

Anaxagoras of Clazomenae held that the best thing is meditation upon life, and the detachment which comes from this. Such a definition of the best thing truly befits a philosopher.

460

Ibid. 12.67

When Socrates was about seventeen years old Archelaus, the disciple of Anaxagoras, made his acquaintance . . .

HERO OF ALEXANDRIA

date uncertain; before Proclus

461

Definitions (Definitiones) 136.10

Geometry was first invented by the Egyptians. Thales brought it to the attention of the Greeks. Thales was followed by Mamertius, who was the brother of the poet Stesichorus, and by Hippias of Elis.

After this, Pythagoras set up the basic axioms of this science and deduced many of its theorems. He drew a distinction between geometrical shapes and the shapes of material objects, asserting that the former are purely abstract entities. Anaxagoras and Plato and, before Plato, Oenopides of Chios, Theodorus of Cyrene, and Hippocrates followed in the footsteps of Pythagoras.

PROCLUS

410–485 C.E.

462

Commentary on Plato's PARMENIDES' LOGICAL EXERCISE (*Commentarius in Platonis* PARMENIDEM) 1, p. 625.10

Antiphon heard these arguments, and told them to certain people from Clazomenae who had come to Athens from the school of Anaxagoras and said that philosophy was their profession.

463

Ibid. 1, p. 629.34

Thus too in the *Phaedo*, Socrates censures Anaxagoras for not making any use of Mind in his theory, and for giving gases, spatial positions, and other such physical mechanisms as explanations of things.[1]

464

Ibid. 7, p. 1214.7 (*On* 140e)

These indeed are basic philosophical concepts common to most of those who investigate the one and only thing they assume exists. Their first assumption is that it is neither material, as the Stoics held, nor an incorporeal spirit, as Anaxagoras said, nor a mind not subject to change, as Aristotle said later.

465

Commentary on Plato's ON THE EDUCATION OF A STATESMAN (*Commentarius in Platonis* ALCIBIADEM I) 147.10 (*On* 105a)

Pericles excelled most people in his way of life. Plato himself says in the *Phaedrus* that he had the good fortune to have a noble character, and that through his association with Anaxagoras he became saturated with the wisdom of philosophy, so that he was more perfect in public speaking than any other orator of his day.[1]

466

Commentary on Plato's TREATISE ON NATURAL PHILOSOPHY (*Commentarius in Platonis* TIMAEUM) 1C

It seems that while other philosophers were asleep, Anaxagoras recognized that Mind is primarily responsible for all other things, which are subject to physical change. However he does not make use of Mind in his explanations of natural phenomena, but instead employs certain gases and ethereal substances to explain physical change, as Socrates points out in the *Phaedo*.[1]

467

Ibid. 63a (*On* 27b)

Socrates also indicates here that he requires physics to conform with the Pythagorean tradition and to begin with a study of the divine factor, rather than to be the sort of discipline he rejected in the *Phaedo*,[1] which blinds the mind's eye by employing gases and ethereal substances as explanations, as Anaxagoras did.

468

Ibid. 258c (*On* 38d)

Plato then—in order to show how much the sun and the moon have in common, and to indicate that a single factor keeps them perfectly attuned to each other—portrays the sun and moon as entering the world together. However he was not the first to maintain this view; Anaxagoras held it earlier, as Eudemus has recorded.

469

Commentary on the First Book of Euclid's ELEMENTS OF GEOMETRY *(In Primum Euclidis* ELEMENTORUM *Librum Commentarii)* p. 65 (B38)

After Pythagoras, Anaxagoras of Clazomenae studied many geometrical problems, as did Oenopides of Chios, who was a little younger than Anaxagoras. Plato mentions them in his *Lovers* as having achieved eminence in the field of mathematics.[1]

SIDONIUS APOLLINARIS

c. 430–479? C.E.

470

Poems 2 *(Carmen* II) 156

He[1] studied . . . all the theories presented by . . . Anaxagoras[2] . . .

471

Poems 15 *(Carmen* XV) 89

The fourth in line[1] is Anaxagoras, who kept intact the doctrine of Thales; but he also perceived the divine soul which fashioned the world.

HERMIAS

disciple of Proclus

472

Commentary on Plato's ON LOVE *(In Platonis* PHAEDRUM *Scholia)* 213 *(On* 269e)[1]

Pericles became "high-minded" because he became interested in philosophy, Plato says. The word "high-minded" is an allusion to

Anaxagoras, who held that Mind is in control of the whole world, though at that time everyone else was saying that such things as gases are responsible for the creation of the world.[2]

HERMIAS

fl. prob. in the fourth and fifth centuries C.E.

473

The Absurdities of the Pagan Philosophers (Irrisio Gentilium Philosophorum) 3

The differences of opinion among philosophers concerning the elementary concepts in natural philosophy are very great indeed. When Anaxagoras takes me aside, he recites to me: "Mind is necessary to understand all things; it is responsible for and controls all things; it sets disordered things in order, imparts motion to bodies at rest, separates compounds into their components, and gives proper form to unformed things." When Anaxagoras says this I am pleased and his theories convince me, but then Melissus and Parmenides come and contradict him in their verses . . . Parmenides has driven Anaxagoras from my mind.

STOBAEUS

wrote prob. in the fifth century C.E.

474

Selected Physical Theories[1] *(Eclogae Physicae)* 1.1.29

Anaxagoras said that God is Mind, the creator of the world.

475

Ibid. 1.7.9[1]

Anaxagoras and the Stoics say that chance is a factor human reason can not grasp: for some things occur because they must, some are fated, some result from deliberate acts, some result from chance, and yet others occur entirely of themselves. Chance is the name given to random activity.

476

Ibid. 1.10.12[1]

Anaxagoras the son of Hegesibulus of Clazomenae declared that the homoeomeries are the basic components of all things. Now, we take in simple food, like bread and water, and from this food veins, arteries, flesh, muscles, bones, and the other parts of the body are nourished. Since the tissues of the body grow in this way, it must be granted that all existing things are in the food we eat, and that they all grow by the addition of already existing things. Food then contains particles whose existence must be deduced theoretically. . . . *(lacuna)* . . . that the particles in food belong to the tissues which grow from them.[2] He called them 'homoeomeries' and basic constituents of existing things. He believed that the homoeomeries are the elementary kinds of matter, while Mind is the factor which fashions things and sets all things in order.

477

Ibid. 1.15.6

Anaxagoras says that the atoms have many shapes. Leucippus and his school say that the homoeomeries have many shapes.

478

Loc. cit.[1]

Diogenes and Anaxagoras say that after the world had been put together and animals had already emerged from the earth, the world somehow inclined all by itself toward its southern part. Perhaps this was a result of Providence, working to the end that some parts of the world might be uninhabited and others inhabited, according to whether the climate is cold, hot, or temperate.

479

Ibid. 1.20[1]

Empedocles, Anaxagoras, Democritus, Epicurus, and all those who say that the world is a collection of bodies made up of fine particles, speak of dissociation and recombination rather than of true physical change. They say that physical change is not a qualitative process and does not come about through qualitative change, but is rather quantitative and comes about through the coalescence of parts.

480

Loc. Cit.

Anaximander, Anaximenes, Anaxagoras, Archelaus, Diogenes, and Leucippus say the universe will come to an end.

481

Ibid. 1.22[1]

Thales, Pythagoras, Empedocles, Ecphantus, Parmenides, Melissus, Heraclitus, Anaxagoras, Plato, Aristotle, and Zeno say there is one universe. Anaximander, Anaximenes, Archelaus, Xenophanes, Diogenes, Leucippus, Democritus, and Epicurus say that there are an infinite number of worlds in the infinite expanse, all through its volume.

482

Ibid. 1.24[1]

Concerning the composition of the heavenly bodies and their structures, motions, and roles in foretokening the weather . . . Anaxagoras says that the surrounding aether is a burning hot substance, whose intense whirling motion snatched up stones from the earth, set them on fire, and turned them into stars. He also says that all the heavenly bodies move from east to west.

483

Ibid. 1.25[1]

Concerning the composition of the sun, its size, structure, the turning points in its course, eclipses of the sun, prognostications from its appearance and its motion . . . Anaxagoras says that the sun is a red-hot mass of ore or of stone, and that its turning point results from the pressure of the air in the north, which the sun compresses and endows thereby with a resistance which increases with density.

484

Ibid. 1.26.1[1]

Concerning the composition, size, and structure of the moon . . . Anaxagoras and Democritus say that it is a fiery solid body with plains, mountains, and gullies on it.

485

Ibid. 1.26.2

Concerning the phases of the moon . . . Thales was the first to say that the moon receives its light from the sun. Pythagoras, Parmenides, Empedocles, Anaxagoras, and Metrodorus agree.

486

Ibid. 1.26.3

Concerning eclipses of the moon . . . Thales, Anaxagoras, Plato, and the Stoics agree with the astrologers in saying that the moon disappears from view every month because it comes into conjunction with the sun and is masked by its light. They say that eclipses of the moon occur when it enters the earth's shadow, when the earth comes between the sun and the moon and quite cuts off the sun's light from the moon. Theophrastus says that Anaxagoras held that eclipses also occur when bodies underneath the moon happen to obstruct it.

487

Ibid. 1.26.4[1]

Concerning the light reflected from the moon . . . Anaxagoras cites the unevenness of its composition, since it contains cold and earth, having high parts, level parts, and depressed parts. He says that there is murky substance mixed in it along with its fiery matter, and that the fact that they are mixed makes the moon seem shadowy. This is the reason that this heavenly body is called 'the body which shines with false light.'

488

Ibid. 1.27[1]

Concerning the Milky Way . . . Anaxagoras says that the earth's shadow is cast upon this part of the sky when the sun is under the earth and so does not illuminate the entire sky.

489

Ibid. 1.28[1]

Concerning comets, shooting stars, and such things . . . Anaxagoras and Democritus say that a comet is a conjunction of two or more stars whose rays meet . . . Anaxagoras says that the so-called shooting stars are carried down from the aether like sparks; this also explains why they are immediately extinguished.

490

Ibid. 1.29[1]

Concerning thunder, lightning, thunderbolts, hurricanes attended with lightning, and typhoons . . . Anaxagoras says that these phenomena occur when heat falls into the cold below, i.e. when a part of the aether falls into the atmosphere. Thunder is produced by the noise, lightning, by the contrast between the color of the aether and the black of the clouds, thunderbolts, by a large quantity of light.

Typhoons are produced by heat substance composed of yet more particles, and hurricanes attended with lightning are produced by heat substance mixed with clouds.

491

Ibid. 1.48.7

Pythagoras, Anaxagoras, Plato, Xenocrates, and Cleanthes say that Mind enters matter from the outside.

492

Ibid. 1.49.1[1]

Concerning life . . . Anaximenes, Anaxagoras, Archelaus, and Diogenes say that life consists of gaseous matter.

493

Ibid. 4.52[1]

Anaxagoras said that we are taught what death is in two schools: before birth and during sleep.

PHILOPONUS

latter part of fifth and beginning of sixth century C.E.

494

Commentary on Aristotle's PHYSICS *(In Aristotelis* PHYSICORUM *Libros Commentaria)* 2.24

Anaxagoras too[1] said there are an infinite number of elementary components of matter—homoeomeries, which are present in infinite number in each object.

495

Ibid. 24.23 (*On* 184b15)

Anaxagoras, Democritus, Epicurus, and Leucippus said that there is more than one basic component of matter; that in fact there are an infinite number, and that they undergo motion and change. Anaxagoras assumed that homoeomeries are the basic components of all things, a homoeomery being something whose parts are like the whole. He says that homoeomerous substances are present in one another; for example wood, which is a homoeomerous body, contains flesh, bone, water, fire, gold, and absolutely everything else, so that an infinite number of homoeomeries are in each and every thing. He came to this conclusion because he observed that all things emerge from one another, if not directly, then through several intermediate steps. Thus, since Anaxagoras was not able to formulate an adequate picture of matter as something capable of being transformed into all things, he conceived a fantastic picture of matter, namely, that all things coexist together. In accordance with this he said that things emerge from one another by a process of extraction, and do not come to be by basic modifications in the nature of matter.

Anaxagoras was right to assume that *homoeomerous* substances are present in one another; for no one would ever assume that a hand is in a face, or a foot in a hand.

496

Ibid. 26.8 (*On* 184b20)[1]

Perhaps, however, the text here refers to Anaxagoras, who said that homoeomerous substances like fire and water inherently possess contrasting properties.

497

Ibid. 87.8 (*On* 187a10)

Next Aristotle mentions the schools of Anaxagoras and Empedocles, since he wishes to clarify further what Anaximander meant when he said that things come to be by being extracted out of the universal substratum. The following is the theory of Anaxagoras: He assumed that the fundamental elements of existing things are: first, homoeomeries, the basic components of matter, which are infinite in number and in variety, and which were all mixed together before the world came to be; and second, Mind, which he introduced into his theory as the factor which fashions all things. Mind began its work at a certain time; its aim was to separate all things from one another, but it was not able to bring about complete separation, separating out only non-homoeomerous bodies, which are composed of homoeomeries. It could not, however, separate out pure homoeomeries, but, having once started the process of extraction when it did, it goes on eternally extracting. Thus all things come to be from all things, because all things are present in one another; for example, wood contains flesh, bone, gold, and absolutely everything else. Each thing is named after the component which predominates in it. Consider the case of a heap of grain: if there is more wheat than other grains in it, it will be called a heap of 'wheat,' after the component which predominates in it. Similarly, when an object contains more flesh than other things, it is called 'flesh,' and when it contains more bone, it is called 'bone.' The same holds in the case of wood, gold, and everything else. Now then, if someone extracts from a heap of grain seeds of barley which were previously imperceptible because there were so few of them, and makes a little heap of barley, he has not created barley, but simply rendered it visible by separating it out. So it is too in the case of physical objects. When bone or anything else comes to be from flesh, coming to be in the strict sense does not occur, but rather something previously hidden from view is made visible by being separated out.

Now in the case of a heap of grain it is possible to separate out one kind, such as barley, in pure form, but in the case of homoeomerous substances this is impossible; for it is not possible for pure flesh, pure stone, pure gold, or anything else in pure form ever to be separated out. Rather, all things must always be present in whatever has been separated out, regardless of its size; and each thing separated out is named after the component which predominates in it. Accordingly, an aggregation of particles of flesh make up flesh, particles of stone make up stone, and similarly for anything else of this kind; and non-homoeomerous bodies too are built up out of homoeomeries. So much for Anaxagoras.

Aristotle says that Anaximander too—like Anaxagoras and Empedocles and their schools who say that physical change is a process of extraction—says that all things come to be, or rather are extracted, out of the elementary kind of matter which he posits . . . Aristotle then returns to the theory of Anaxagoras.

Thus, having said these things, Aristotle turns to the refutation of Anaxagoras' theory.[1] But before he launches into specific arguments he tells how Anaxagoras was led to his theory, i.e. what thoughts moved him to assume that all things are in all things, and that nothing is pure. Aristotle says that he was brought to this view by two things: first by his acceptance of the common opinion of all physicists that something cannot come to be from that which in no way exists. For he used the following reasoning: all things come to be either from existing things or from things which do not exist. (It is clear that the source of his error lies in this distinction; Anaxagoras neglected to include one of the possibilities: for everything comes to be either from something which is absolutely nonexistent, or from something which absolutely is, or else from something which exists in one sense and does not exist in another. He omitted the last kind of coming to be, which also is a way things in fact come to be, and so fell into his error.) Hence, since all things come to be either from existing things or from nothing and in no other way, and since it is impossible—according to the common assumption—for them to come to be out of nothing, they must come to be out of things which existed previously. If they come to be out of things which existed previously, these previously existing things must either be the same as, or different from, the objects which come to be from them. Now it is impossible for them to be different; for humans produce humans and horses horses, but a human never gives birth to a horse. Since, then, all things must come to be from things of the same kind, it must certainly follow—if we take a case where bone is observed to arise from flesh—that the bone must have been present earlier in the flesh, since it arises out of it, and since things of different kinds cannot arise from each other. This is so in the same way in all cases.

Now everything comes to be from everything either directly or through intermediate steps; e.g. blood arises from bread, flesh from blood, and often in turn bone as well as other things from flesh, since rotting flesh can produce water, heat, earth, worms, and all kinds of other things. Therefore it must certainly follow that one must hold that all things are mixed in all things, for Anaxagoras did not use the concept of a universal substratum in his theory, so that it followed for him that everything comes to be from everything else.

This is the first thing that convinced Anaxagoras to adopt this theory. The second is the fact that he observed that an object passes from one state into its opposite; e.g. something becomes hot after being cold, dry after being wet, white after being black, and so on. Now one of a pair of contrasting qualities never gives rise to the appearance of the other; but one of such a pair tends to suppress the other rather than produce it. Therefore Anaxagoras was forced to hold that particles of warm matter are present in a cold body and that heat is produced when these are extracted; that contrasting qualities, then, must certainly coexist in one and the same object; and that each object must be said to have a certain property according to the one which predominates—i.e. it must be said to be warm when there are more warm particles in it than anything else, and to be cold, white, or anything else in the same way.

498

Ibid. 93.20 (*On* 187a21)[1]

Aristotle has told us that Anaximander held that matter possessing different properties emerges from the universal substratum by a process of extraction. Now, in order to clarify further what he meant by this, Aristotle brings the theories of Empedocles and Anaxagoras as cases in point and explains what these thinkers meant when they said that their elementary kinds of matter are separated from one another; for they also hold that things emerge from a material mixture. Anaxagoras says that the homoeomeries, which were previously all mixed together, were separated out of the mixture by Mind, and that now too they are continually being separated from one another, for he holds that each object is a mixture of homoeomeries. Empedocles too holds that the basic kinds of matter were initially separated from each other out of the Sphere, and he says that now the four kinds of matter are mixed with one another—but *not* all mixed together, as Anaxagoras said—and arise from one another by separation in the way we have outlined. But Anaxagoras and Empedocles differ: Anaxagoras held that at a certain time Mind began to separate things out of the primeval mixture, that it continues to do this eternally, and that all things can never again coalesce to form one mixture. Empedocles however says that this process happens often; for at one time, he says, the different kinds of matter are separated out of the Sphere, and at another time they again coalesce to form the Sphere, and this cycle recurs periodically an infinite number of times. This is one difference between Empedocles and Anaxagoras. Another is that Anaxagoras says that the elementary kinds of matter—i.e. for him, the homoeomeries—are infinite in number, whereas Empedocles says that they are these four: heat substance, colorless gas, clear liquid, and dry dust. Aristotle calls them the "so-called elementary kinds of matter" because they are not really elementary; for they are not simple, but compound. What is really elementary is matter and its properties.

499

Ibid. 94.17 (*On* 187a26)[1]

Next Aristotle wishes to lay bare the reasoning which led Anaxagoras to assume that the homoeomeries are infinite in number, and that all things are mixed in all things. Aristotle says it is because he accepted the theory of the physicists that something cannot come to be from that which in no way exists, so that that which comes to be must have existed previously, and coming to be must therefore be a process of separation. He said that all things are mixed in all things because he observed that everything comes to be out everything. Since he assumed that coming to be is a continuing process and never stops, he concluded that there must be an infinite number of homoeomeries in each thing to ensure that there will be no end to coming to be, i.e. to the process of separation.

500

Ibid. 94.27 (*On* 187a29)[1]

Aristotle says that because the physicists assume that something can not come to be out of that which in no way exists they say that all things always coexisted. Anaxagoras especially stresses this . . . Anaxagoras obviously says that the homoeomeries participate in processes of separation, and that this constitutes coming to be. When a compound is formed, he says, many homoeomeries are combined; and when it is destroyed they are again separated from one another. In addition all physicists hold that qualitative change results from processes of combination; for things which are extracted, combined, or dissociated undergo a sort of qualitative change—some by changing place, and others by changing their relative positions in the field of vision.

501

Ibid. 95.21 (*On* 187a31)[1]

Anaxagoras reached the conclusion that all things are in all things because something cannot come to be out of nothing; because an object passes from one state into its opposite; and because pairs of contrasting properties tend to cancel one another out rather than to enhance one another. Thus, Anaxagoras concluded that all things are in all things, though they do not come into view because of the smallness of their volume; and that each thing is named after the component which predominates in it, as in the case of a heap of grain. Just as a heap of grain is called wheat if wheat predominates over all other kinds of grain, so when flesh or water predominate in an object it is named accordingly. Anaxagoras was led astray by the assumption that things must come to be either from total, unqualified nothingness, or else from that which exists, and in no third way. In fact however something *can* come to be from a nonexistent thing—not from something which does not exist at all, but from something which is not a *particular* thing. In what follows Aristotle will bring this charge against him and refute him.

502

Ibid. 96.3 (*On* 187b7)[1]

Having presented the theory of Anaxagoras and the reasoning that led him to his theory, namely, that he thought that something can not come to be out of nothing, and that he observed that an object passes from one state into its opposite, Aristotle now turns to the refutation of Anaxagoras' theory and brings several arguments to demolish it.

The first argument is intended merely to embarrass Anaxagoras and is not completely in place here. Rather it is a general argument applicable to Anaxagoras and to scientists in general, as well; for it shows that Anaxagoras' theory makes it impossible to know anything. This is the argument: If the basic components of all things are homoeomeries, and if they are infinite in number, then, since by its very nature nothing infinite can be grasped, the basic components of existing things can not be comprehended. Further if the basic components of a thing can not be known then the thing itself is unknowable, so that all existing things are unknowable. Thus Anaxagoras' theory makes any science dealing with actual objects impossible, since he does away with knowledge of existing things; for science is a particular kind of knowledge. The nature of science is to encompass and grasp things logically. It is impossible however for the mind to encompass the infinite rationally, for as soon as we encompass something we make it finite, while when dealing with infinites it is always possible to find something beyond what you have. Indeed the most exact sciences, geometry and astronomy, would be done away with.[2]

It is clear that Anaxagoras attempted to instruct us about existing things because he believed he possessed scientific knowledge. It follows then that either Anaxagoras was really a scientist, in which case the basic components in his theory cannot be infinite in number, or they are infinite in number, in which case he was no scientist. If he was not a scientist we are certainly not going to believe him when he tries to explain to us things he does not know. This then is Aristotle's first argument; its object is to embarrass Anaxagoras, as I have said, and it is not really pertinent.

The following hypothesis underlies the second argument, which *is* pertinent: All species, Aristotle says, subsist in nature in a certain definite range of size, and can neither increase nor diminish arbitrarily in their natural state. Rather there are bounds, both upper and lower, outside of which a species can not exist. Let us first discuss the more perfect species. Since they have a greater number of distinguishing features, the argument will be clearer. A fully formed human being can be one cubit tall and also four or five cubits tall, but he can not be infinitely tall. In fact no human being a hundred cubits tall or as large as the whole world can exist as long as we are dealing with real men and not with imaginary men. Clearly a real man can not grow excessively—surely not to a greater size than the world—since there is some definite size which he can not exceed. Indeed if any member of a species contains an excessive quantity of matter, its distinguishing characteristics disappear. Further, just as it is impossible for members of a given species to increase to an arbitrarily large size, so it is impossible for them to diminish to an arbitrarily small size. Pygmies can exist, but not a person a finger's breadth in size, or one the size of a fig seed;[3] for an extremely small quantity of matter can not preserve the distinguishing marks of a species. In the same way it is obvious that a wood carver can make a model of a ship out of a piece of wood a cubit long, but not out of one a finger's breadth in length, and a potter can not make a jug out of a lump of clay the size of a fig seed. Therefore just as in these examples the size of the objects must lie between certain limits in order for them to have well-defined properties, so must the size of homoeomeries, for homoeomeries are also species having definite properties. It is clear then that flesh, bone, or water can neither be arbitrarily large—certainly not as large as or larger than the whole world, for then they could not exist, and we are talking about actual objects—nor arbitrarily small, since there is always some lower bound to the size a piece of flesh can assume and still remain flesh. Therefore there must be a certain smallest piece of flesh which can not be divided and still be flesh, and the same holds for all homoeomeries.

This can be seen from the following considerations: Composite bodies are not formed out of a random mixture of matter, but each kind of body requires matter mixed in a way appropriate to its properties, for a given set of properties can only be produced in matter which is suited to contain them. For example, the properties of flesh could not be produced in a random mixture of elementary kinds of matter, nor could the properties of bone. Rather the properties of flesh require one kind of mixture to subsist in as flesh, the properties of bone require another, and similarly each thing requires a different mixture. Now, since this is so, there must be not only a certain characteristic property which determines the nature of each kind of composite body, viz. the characteristic proportion of the elements composing it, but also some definite measure; for it is reasonable to assume that just as composite bodies can not arise from any random mixture, so they can not exist in any random size. Indeed inasmuch as a definite measure and a definite proportion are equally necessary to a thing's existence, we have no choice but to assume that a composite body can not be of random size, since the mixture of which it is composed can not be random but must be governed by definite proportions. We must conclude then that the size proper to a species lies within definite limits. Therefore there is some minimum size in which flesh can exist and some minimum size in which water can exist, and these sizes form a lower bound.

This is just what one would expect; for if it is true that matter which is about to be made into flesh must undergo some change at the hands of the factor which fashions it, then it is reasonable to assume that just as a piece of matter which is about to be subdivided cannot be subdivided into arbitrarily small parts, because at a certain point it is too small to be subdivided any further (even though a further subdivision of the smallest sized particle can always be conceived theoretically), so too a piece of matter which is about to undergo a change in property will not be able to undergo it if there is an arbitrarily small amount of it because at a certain point it will be too small to undergo any change of property, and it is clear that it can only take on the set of properties intended for it by the fashioning agent if it can undergo a change in its properties.

Mathematicians may object here and say: Since any given line can always be cut in half (for any given magnitude can be subdivided indefinitely), clearly we must be able to divide in half the minimum amount of flesh which we are talking about. Will then the pieces which result from this subdivision be pieces of flesh or not? If they are, then it is possible to have a piece of flesh smaller than the one you gave as the minimum, and that smallest piece of flesh would not in fact be the smallest possible. If however the pieces which result from this subdivision are not pieces of flesh, how can they be put together again to form flesh? If flesh is homoeomerous then clearly any part of it is flesh. It must therefore be possible to obtain a piece of flesh smaller than any given piece of flesh, since flesh is indeed homoeomerous. Our answer to this is that flesh can be considered as an object characterized by certain properties as well as an object having extension. As an extended body flesh is indefinitely subdivisible, so that in this respect one can never reach a minimum size. However insofar as it has properties it can not be indefinitely subdivided; rather the division will always terminate with some smallest piece of flesh which once subdivided will no longer preserve the properties of flesh. The case is similar with man. It is possible to consider man either as man or as an extended body. As an extended body it is possible to hold that he is indefinitely subdivisible into pieces with the same nature. However if I divide man considered as man into head and feet, the division will destroy the structure 'man,' and this structure will survive neither in the whole—for there will remain no whole—nor in any of the parts; for man considered as man is indivisible. In the same way if you subdivide the smallest piece of flesh, in the process of subdivision you will destroy its properties; for the smallest piece of flesh considered as flesh is indivisible, and the parts which result from its subdivision have extension but are not flesh. Now even if you throw together the parts of a man in ten thousand different ways you will never again get a man, because to make a man you must not only put together all the parts but you must also provide the distinguishing characteristic which coordinates the parts and gives them their properties. Similarly in the case of the homoeomeries, even if you throw together in ten thousand different ways the parts of the smallest piece of flesh after it has been subdivided, you will never again get flesh as long as the distinguishing characteristic of flesh is not present in it. When all the lumber which goes into a ship is piled up there is yet no ship, and when all the lumber and stone which goes into a house is piled up there is yet no house, as long as no artisan is present to build them. So too when you throw together the parts of which flesh is composed you do not get flesh as long as the distinguishing characteristic which coordinates these parts is absent. The minimum amount of flesh can be called a homoeomery only as long as it remains whole, since then it has the properties of flesh; and then, since the whole is flesh, the parts which can be *conceived* to exist in it are flesh. However, after it is subdivided, the parts are no longer flesh.

This demonstrates that there exists a lower bound to the size of a piece of flesh, in agreement with our introductory remarks. For certain predicates have universal application to all things and pertain to all things; for example, the predicates 'being' and 'unity,' for there is nothing that does not have being and unity as attributes. On the other hand, what people refer to as irreducible predicates have a more limited range of application. They are limited to the specific properties to which they refer, and cannot be predicated of more than one type of thing—'man' can be predicated only of man, and 'horse' only of horses—nor can they apply to the objects they denote if these objects are in an arbitrary state or condition: for a corpse is not a man, nor does a piece of a man constitute a man any longer. Flesh, blood, and other homoeomeries, however, occupy an intermediate position: They can be applied to fewer things than can the predicates 'being' and 'unity,' but to more than can irreducible predicates, since 'flesh' and 'bone' can be applied to horses and other animals and also to pieces of animals, but they can not any longer apply to subdivisions of the minimum amount of flesh or bone; for the predicates 'flesh' or 'bone' can no longer apply to these subdivisions, though 'unity' and 'being' still can, because subdivisions of the smallest bit of flesh still exist as actual objects, as material bodies which have extension, though not as flesh.

The second assumption Aristotle makes is that every finite body contains only a finite number of objects of finite size, i.e. a larger body contains a finite number of smaller ones. For example, a body a hundred cubits long contains a unit of ten cubits ten times, and a unit of one cubit one hundred times, and it can also be measured by a certain number of finger's breadths. In general a finite body can always be measured by any smaller finite measure.

With this assumption Aristotle proves that it is impossible for all things to be in all things, and for a process of separation to go on indefinitely. This is the first *pertinent* argument, though the second of the arguments against Anaxagoras. Aristotle says: If a piece of a given homoeomerous substance, e.g. flesh, is extracted from another homoeomerous substance, e.g. water, and this is repeated again and again and again, then, since the flesh in the water is also finite in volume (which it must be, because the homoeomerous water is also finite in volume), and since every finite volume must eventually be emptied if bodies of finite size are continually taken out of it, it must certainly follow that the flesh in the water will give out if little pieces of flesh are continually extracted from it. Nor is it valid to use the fact that extended bodies are indefinitely subdivisible to prove that the flesh in the water would not give out if it were taken out in ever smaller pieces, as might happen for example if each piece removed is half the size of the previous one; for if it is, the minimum size a piece of flesh can have will still surely be reached—and it has already been shown that such a minimum size exists. If then this minimum size is reached as the flesh in the water is subdivided, it is clear that after that piece is taken away, no flesh can any longer be separated from the water. In that case all things will not be in all things, nor will it be possible for a process of extraction to go on indefinitely.

It makes no difference whether the flesh extracted is pure, or mixed with other homoeomeries. Even if the pieces of flesh extracted do not emerge pure, still, since we assumed that extraction could go on indefinitely, then it must certainly follow (even if the pieces of flesh which are separated out are always of the minimum size) that all the flesh in the water will eventually give out, by the second assumption mentioned above that finite bodies contain a finite number of finite bodies. Hence the process of extraction cannot go on indefinitely. One of two alternatives is open: either the process of extraction of flesh will stop, as the argument has shown it must; or, if pieces of flesh could be separated out of the water indefinitely, it would have to follow—since the minimum piece of flesh is finite in size—that there are an infinite number of similar bodies in a finite volume. This is impossible since it amounts to saying that an infinite body is contained in a finite one, whereas in fact if a body were composed of an infinite number of parts it would itself be infinite.

The third argument Aristotle uses is similar. If the size of a piece of flesh is bounded in both directions, it is impossible for anything to be extracted from the smallest piece of flesh. For any finite body is diminished in size when something is taken away from it, since every finite body contains a smaller finite body a finite number of times. If then something could be extracted from the smallest piece of flesh, it would be smaller than the smallest piece. This is impossible. Therefore all things are not in all things.

The fourth argument is as follows: Aristotle says that if everything is in everything, and if the process of extraction goes on indefinitely, each homoeomery must contain an infinite number of pieces of flesh, an infinite number of pieces of bone, and an infinite number of pieces of all things. Again, each piece of flesh, blood, or anything else in each homoeomery must in turn contain all things an infinite number of times, and so in turn must each one of these. Therefore there must be an infinite number of infinite bodies in each homoeomery. What could be more ridiculous than a conclusion that says that there are an infinite number of bodies, infinite both in number and in extent, in the smallest piece of flesh? For these bodies will be infinite in *number* because they are distinct from one another and only touch one another,[4] and they must be infinite in *extent* because anything composed of an infinite number of bodies must be infinite in extent. Indeed not only will each homoeomery contain an infinite number of infinite bodies, but the space these bodies occupy will also be infinitely infinite. This is because those homoeomeries which are not in their places, but have already been extracted, have been separated from the others; they too are infinite, so that the space which contained them must be infinite, and the intervals which separate them must also be infinite in total volume. Therefore we will be left with infinitely many times infinity infinitely many times, which is absurd.

In the fifth argument, Aristotle says that Anaxagoras' Mind is mindless. Its aim is to separate all things, both as far as measure and as far as qualities are concerned, in order to separate from one another different kinds of homoeomeries, e.g. homoeomeries of flesh, bone, and the rest, as well as homoeomeries which are of the same kind, e.g. of flesh, but are distinguished from one another by each having a number assigned to it. Mind cannot achieve this however because any extended body can always be subdivided again,[5] and because it is impossible for different kinds of homoeomeries ever to exist in a pure state. Thus Mind is mindless since it attempts the impossible.

Aristotle also says[6] that Anaxagoras said correctly that no separation can ever be complete, but that he said it without real comprehension. Attributes and states belong to real objects and can never be separated from that in which they subsist. Now if Mind desires to separate all things, it must desire to separate attributes and states. However it is impossible to separate them. Therefore Mind is mindless inasmuch as it seeks to do mindless things.

Aristotle also says that Anaxagoras is wrong in assuming that objects come to be out of things with the same properties that they possess. Aristotle says that sometimes they do, as when a piece of mud comes to be from pieces of mud which have the same properties as it does, i.e. when a larger piece comes to be from smaller pieces. On the other hand, sometimes mud comes to be out of components whose nature is different from its own, i.e. out of water and earth. So too a house comes to be from bricks and lumber which are different from a house. Thus Anaxagoras was wrong in simply assuming that things come to be out of parts having the same nature. We see this not only in fabricated objects, but also in naturally occurring ones. Fire comes out of wood, and gas out of liquid, and different animals out of decaying matter—not only out of living bodies when they putrefy, but also out of lifeless ones.

After having said all these things, Aristotle adds that if one has a choice of accounting for the formation of things with an infinite number of basic components of matter or with a finite number, it is better to do it with a finite number, for infinity cannot be comprehended. Thus Empedocles did better than Anaxagoras, at least in so far as he assumed a finite number of basic components.

503

Ibid. 101.29 (*On* 187b7)[1]

"Since anything infinite can not be grasped because it has no limits" begins the first argument, which is intended to embarrass Anaxagoras. 'Infinite' refers either to infinite number or to infinite variation in quality, and infinite variation in quality implies the existence of an infinite number of objects. Indeed if an infinite variety of properties exists, then the objects to which they belong must be infinite in number; though it does not follow that numerical infinitude implies infinite variation in quality, since it is possible to have an infinite number of objects with identical properties. The same arguments that apply to the infinite apply to that which can not be comprehended.

If, then, Anaxagoras had assumed that the basic components of matter are infinite in number but finite in variety, it would be possible to comprehend the varieties of basic components of things, but not their number. Since however Anaxagoras assumes that the basic components are infinite both in number and in variety, it is clear that the basic components are entirely beyond comprehension. Therefore any body composed of them is also unknowable, for compounds can be known only when we know the number and kind of the basic constituents of which they are compounded.

504

Ibid. 102.11 (*On* 187b13)[1]

The first assumption is that there is an upper and lower bound to the size of a piece of flesh and of all other specific objects, so that they can be neither indefinitely large nor indefinitely small. Aristotle proves this on the basis of a consideration of the wholes—i.e. of the composite bodies—of which homoeomeries are parts, a consideration which he employs in the minor premise of his syllogism. The reasoning is: If it is possible for the parts of an object to be indefinitely large or small the same would be true of the whole object, since the whole is composed of its parts and can not increase or diminish in size unless its parts do also. However it is impossible for the whole to be indefinitely large or small. Therefore the parts can not be either. Accordingly the size of the parts is bounded in both directions. There must therefore be some smallest piece of flesh and of bone, just as there must be a largest.

Perhaps however somebody might defend Anaxagoras and argue against the first premise. He would say that even if the homoeomeries could be infinitesimal, animals and plants need not be infinitesimal. This would follow only if there were only *one* homoeomery of flesh, one of bone, and one of blood, since then and only then could it be concluded that the whole increases and diminishes as its parts do. As it is however this is not the case. Rather, *many* homoeomeries of flesh, bone, and other things coalesce to make up the flesh and the bone of an animal. Thus it is not necessary for the animal to diminish in size along with the homoeomeries, since it is possible for a great many homoeomeries, even if each one is small, to combine to form the body of the animal. For instance, in the same way, it is possible for the stones which make up a house to be infinitesimally small and for the house not to be, because the house is composed of many stones rather than of one single stone. For the same house can be built of fewer stones if they are larger, and of more if they are smaller.

However even if this is the case, the number of homoeomeries which compose the flesh of a human being must still be finite. Let us suppose then that there are five homoeomeries of flesh. Can they become infinitesimal, or not? If they can, some point will be reached where it will no longer be the flesh of a human being; for example, when the homoeomeries shrink to the size of a finger's breadth or a grain of millet. Now since it is impossible for a human being to be that small, it is clearly impossible for the homoeomeries to be; so that the argument has reverted to its point of departure.

The following objection might be raised: Let the homoeomeries really be arbitrarily small and let the distinguishing characteristics of the body—e.g. man—formed out of them simply not appear if the homoeomeries in it are smaller than a certain size! Thus we know that flesh can exist even in very small quantities—since the flesh of an adult is the same in nature as the flesh of a child or of an embryo, but still you must admit that the amount of flesh in a mature animal does not have to be reduced very much before you reach a size which it is impossible for the animal to assume. Accordingly the homoeomeries could be indefinitely subdivisible, whereas the animal formed out of them would simply not exist if it were made up of pieces of homoeomerous matter which were arbitrarily small.

This argument however does not proceed upon Anaxagoras' own premises, since he said that a composite body is nothing more than an aggregation of juxtaposed homoeomeries. For *us* the argument would be valid, since we say that in addition to a certain arrangement and organization of matter, certain specific characteristic properties—which are not attached to the matter of which a composite body is made—are necessary for the formation of a compound body out of its various basic constituents, and these characteristic properties can not be found in an arbitrary collection of homoeomeries. For Anaxagoras however it is reasonable to assume that the whole always decreases in size as the homoeomeries do, since for him the homoeomeries are basic and there is no other factor besides. Thus for example he believes that the colors which can be observed in the various membranes and hairs of the eye—as well as *all* the properties of composite bodies—are basic. What reason is there then in Anaxagoras' theory why a small number of homoeomeries—or else small homoeomeries—of the tissues of the eye should not coalesce to form a small eye, just as a large number—or large homoeomeries—coalesce to form a large eye?

Accordingly on Anaxagoras' own premises the major premise of Aristotle's argument, that the size of a body is directly proportional to the size of its parts, necessarily holds. However, what can it possibly mean to say that the flesh of a human being is made up of many little pieces of flesh? And why wouldn't each one of this multitude of little pieces of flesh be composed of yet more pieces of flesh—especially since the homoeomeries are infinitely subdivisible? Truly then there must either exist no such thing as a homoeomery, or else the flesh of a human being must constitute only one homoeomery.

Another ridiculous consequence of this theory is that it would turn out that the flesh of an elephant might be composed of fewer pieces than the flesh of a gnat, since there would be no difference between the words 'more' and 'less' if the size of the basic building blocks were unbounded in both directions.

505

Ibid. 104.30 (*On* 187b22)[1]

Here Aristotle's intention is to set forth the first argument.[2] Next he states Anaxagoras' assumption, and before taking it to its logical conclusion he proposes the second premise. The first argument is made up of Anaxagoras' assumption, along with the second premise which Aristotle states as follows: "and if we grant that a finite volume can contain only a finite number of objects of finite size" . . .

506

Ibid. 106.10 (*On* 188a3)[1]

When Aristotle says 'distinct' he means having actually distinct positions in space, and not distinct in the way we use it when we say that all the things which are in matter potentially are distinct. When Anaxagoras made the statement that all things are in all things, he did not mean what we do when we say that matter is potentially all things. He meant that all things are in all things in the way that all types of grain—for instance, barley, wheat, and all the rest—are actually present in a heap of grain. Thus he says that there are present in each homoeomery an infinite number of bodies, and that each of these is likewise infinite, i.e., composed of an infinite number of bodies.

507

Ibid. 106.20 (*On* 188a5)[1]

The Mind in Anaxagoras' theory is mindless since it attempts the impossible, wishing to separate all things, which is impossible.[2] But though Anaxagoras spoke without real comprehension when he said that all things would never be separated, still he was right. He said that the material bodies would never be separated from one another, or else that attributes and states would never be separated from matter, not because he thought it impossible for them to exist independently, but because he thought that it is impossible for the mixture ever to be separated into pure components. This is like saying that it is impossible to separate wine and honey from honeyed wine. Therefore since attributes and states are properties of all objects and cannot exist independently, and since Mind seeks to separate them in its desire to separate everything, Mind must be mindless, inasmuch as it attempts the impossible.

508

Ibid. 108.17 (*On* 188a19)[1]

. . . and then he refutes Anaxagoras' theory which holds that the basic components of matter are infinite.

509

Ibid. 109.8 (*On* 188a19)[1]

Aristotle has shown in his argument against Anaxagoras that the basic components of matter can not be infinite in number.

510

Ibid. 110.11 (*On* 188a19)[1]

Both Democritus and Anaxagoras held that dissociation and recombination account for all physical change. The latter says that the dissociation and recombination of homoeomeries constitute physical change . . .

511

Ibid. 169.12 (*On* 191a23)

Aristotle also refers to certain arguments which we have already mentioned in our discussion of his arguments against Anaxagoras, and which show that physical change does not exist.[1]

512

Ibid. 229.8 (*On* 194a12)

Despite the fact that Anaxagoras says that Mind fashions everything that exists into specific objects, Aristotle does not mention him here. Perhaps this is because of the passage in the *Phaedo*[1] where it says that though Anaxagoras said that Mind is responsible for the formation of the universe, he did not use Mind to explain the details of physical change, but reverted instead to mechanistic explanations. For Anaxagoras explained things by means of homoeomeries of flesh, bone, and the rest, which he held to be material and to account for everything.

513

Ibid. 264.7 (*On* 196a17)[1]

So that no one may say that the ancient philosophers employed chance—i.e. isolated occurrence—in their theories, i.e. that Empedocles identified Affinity and Repulsion with chance—i.e. isolated occurrence—Heraclitus Heat, and Anaxagoras Mind, Aristotle explicitly asserts that these ancient philosophers did not identify these entities with chance—i.e. isolated occurrence. The reason for this is, first of all, that they did not consider chance a determinate concept; and second, that the concepts they use are well-defined and produce well-defined effects. Thus Affinity brings things together and Repulsion separates them, and for Anaxagoras Mind attempts to separate the homoeomeries. On the other hand chance—i.e. isolated occurrence—is indeterminate and produces indeterminate effects.

514

Ibid. 312.8 (*On* 198b14)[1]

So that no one may say that Anaxagoras assumed that Mind is responsible for all physical change and that Empedocles assumed that Repulsion and Affinity are, and that they did not simply give mechanistic explanations of phenomena, Aristotle explicitly asserts that even though they assumed the existence of factors responsible for fashioning things, they mentioned them just enough to touch on them, and no more, but did not hold that they are responsible for particular instances of physical change. Rather each one had recourse to the kind of matter in his own theory to explain such instances, one citing the homoeomeries as explanations, the other citing cold and hot things. Plato, before Aristotle, also brought this charge against Anaxagoras, saying that though Anaxagoras awoke while all the other physicists were asleep—in that he held that Mind is responsible for fashioning the world—nevertheless when he explained particular phenomena he forgot his Mind as it were, and used the homoeomeries, which in his theory were material.

515

Ibid. 396.1 (*On* 203a19)[1]

"Those who believe there are an infinite number of elementary components of matter" refers to Anaxagoras, and to Democritus and his school. The former held that the homoeomeries are infinite in number while the latter held that the atoms are infinite in number. They differ from those who believe there exists only one basic kind of matter infinite in extent—i.e. from those who asserted that the basic kind of matter is clear liquid or colorless gas or something in between—in that they say that that which is infinite is made up of bodies in direct physical contact; for inasmuch as there are an infinite number of homoeomeries, a single infinitely extended body results from their being in direct physical contact with each other. The others however say that that which is infinite is a simple continuum because it is one physical substance.

516

Ibid. 396.13 (*On* 203a20)[1]

Democritus and Anaxagoras differ with the other physicists in that they say that the infinite universe is composed of an infinite number of particles in contact with one another, while the others say it is a continuum. Democritus and Anaxagoras conclude this from their assumption of an infinite number of material particles and they end up with a universe which is infinitely large. This they have in common, but they differ from one another in that Anaxagoras says that homoeomeries emerge out of one another by a process of extraction, while Democritus does not hold that atoms arise out of one another.

517

Ibid. 396.21 (*On* 203a23)[1]

Aristotle says that Anaxagoras held that in the beginning all things in the universe were mixed together, and that it was like one great homoeomerous body, containing everything in it. Similarly he said that all things are present in each individual object. Aristotle says that Anaxagoras was led to this opinion because he observed that everything comes to be from everything else and that something does not come to be from nothing or from something of a different nature; rather, things come from other things like them. Thus any particular piece of flesh actually contains all things, and the first thing to arise out of it is whatever is suited to arise out of it first. Aristotle says that it seems that this is the reason Anaxagoras stated that all things in the universe were once together; for, he says, since any piece of flesh or bone comes to be out of all things, and all things out of it, then anything at all comes to be from anything, and in the same way all things come to be from all things. Furthermore if all things come to be out of all things, then, just as the process of extraction leading to the formation of any piece of bone or of flesh must begin at a certain time, so too there must have been a time when the separation of all things in the original mixture began. Therefore all things must have been together before the process of separation began: for if there was a time when the process of separation of all things began, and if everything really does emerge out of everything else, then before the process of separation began all things must have been together, since as we said, every process of separation begins at a certain time. Next Aristotle, speaking as it were for Anaxagoras, proves that there must be something which originates every process of separation. He does this by adopting certain of Anaxagoras' assumptions, and by reasoning step by step from these assumptions to other statements in Anaxagoras' theory. It may seem that Aristotle is contradicting what he said in his first argument against Anaxagoras: there he said that Mind strives to separate the homoeomeries but can not, and he called Mind mindless because it attempts the impossible. Here he says that Mind did in fact begin to separate the homoeomeries from one another at a certain time. In my opinion however there is no contradiction. In the first argument he was talking about particular homoeomerous bodies, and saying that Mind can not separate out a homoeomerous body—e.g. flesh—in pure form free from other basic forms of matter. Here he says that Anaxagoras held that Mind separated the one infinitely large homoeomerous mixture which contained all things, and to which his statement "all things in the universe were together" applies, into a number of homoeomerous bodies. These bodies are not themselves pure, but again contain all things, and present the appearance of the component which predominates in them, after which they are named.

518

Ibid. 397.23 (*On* 203a28)[1]

Aristotle wishes to prove that there must be something which originates the separation of all things, and that before they were separated, all things in the universe were together, in one another.

He assumes that each thing comes to be from something of like nature, which is why he says "from such a body"[2] and that all things come to be, "but not together,"[3] that is, that one thing comes to be before another since it is more suited to emerge first. Aristotle says there must be something which originates and brings about coming to be, and that according to Anaxagoras this something is Mind. If then all things come to be, and if Mind, the source of all coming to be, began to separate things at a certain time, Mind is what originates the separation of all things.

Now we know that everything comes to be from everything. And anything which comes to be cannot have come to be from something unlike it. Therefore all things must be in all things, in order that all things may come out of all things. Now before Mind began to separate, nothing was separate; for nothing besides Mind can separate things. Thus all things must have been together. For if all things in nature did not come to be from all things, then even if it were true that Mind is responsible for the separation of things, it would not follow that all things were once together. Similarly, if Mind alone were not responsible for separation, then even if it were true that all things in nature come to be from all things, it would not follow that all things were together in one another, since the universe might have been divided into small homoeomerous bodies then, just as it is now.

519

Ibid. 407.11 (*On* 203b11)

Aristotle says that those ancient physicists who do not make reference to something responsible for the formation of all things as did Anaxagoras when he spoke of Mind . . .

520

Ibid. 407.24 (*On* 203b11)

Just as these ancient physicists who used only matter to explain all phenomena assumed that matter is primarily responsible for all existing things, so Anaxagoras assumed that Mind is the origin of all things . . .

521

Ibid. 409.5 (*On* 204a1)

In the arguments against Anaxagoras and Democritus in the first book, Aristotle proved that nothing numerically infinite can exist . . .

522

Ibid. 448.13 (*On* 205b1)[1]

Aristotle says that the reason Anaxagoras gives why the infinite universe is stationary, i.e. at rest, is absurd. According to Anaxagoras the infinite universe is composed of all the infinite homoeomeries which, he said, Mind began to separate at a certain time. Anaxagoras said that this entire mixture is motionless for the following reason: He did not say that it is at rest because it is in that part of space where it would *naturally* remain at rest—for he said that it is not in any part of space at all, because if it were, he would have to have posited a finite universe once and for all. Rather he said that it is at rest because it holds itself in place, that is, it supports itself and leans on itself. It possesses this property because it is neither in anything nor enclosed by anything, but it is in itself and is itself the place it is in. Aristotle says that in saying this Anaxagoras implies that any object is always in that part of space where it naturally remains at rest, no matter where it is. Indeed if you do not assign to an object a specific place where it is naturally at rest, but assert instead that a thing is at rest because it holds itself in place and is in itself, it would be just as possible for it to be in a state of rest somewhere else, where it would be in itself and support itself just the same. But this is nonsense . . .

523

Ibid. 450.2 (*On* 205b1)[1]

. . . Anaxagoras should have given a physical reason for the state of rest of the infinite universe. The reason which he gives does not derive from the inherent physical properties of the infinite universe—i.e. the mixture of all things—but from its size . . .

524

Ibid. 465.3 (*On* 206a14)

Aristotle says that it is not at all difficult to disprove the proposition that a line is made up of indivisible segments. This is the assumption that those who tried to solve Zeno's paradox made, as Aristotle has told us in the first book. Indeed there exists a whole book written by Aristotle against Anaxagoras, called *Concerning Indivisible Line Segments,*[1] where an attempt is made to demonstrate that indivisible magnitudes cannot exist.

525

Ibid. 607.12 (*On* 213a12)[1]

Anaxagoras then, as well as the others who tried to prove that the void does not exist, did not meet the problem head-on. He did not show that what is usually designated by the word 'void' does not exist, nor did he deal with the inherent physical properties of the void, but he only disproved the existence of what the word 'void' designates when it is misused. He should have based his attack on the correct designation and not on the mistaken one . . .

526

Ibid 614.1 (*On* 213b3)

Aristotle says that those who say that a void exists are more persuasive than those like Anaxagoras who object that it does not.

527

Ibid. 833.1 (*On* 256b24)[1]

Aristotle always praises Anaxagoras for having said that Mind is in control of the ordering of all things. Anaxagoras' theory is that all the homoeomeries were mixed together and that Mind separated them and caused them to participate in processes of physical change. Anaxagoras held that Mind is the source of motion and change. Hence he said that it cannot be affected and is free from admixture. It follows from this that Mind never changes, since Anaxagoras said that change is dissociation and recombination; and Mind, being something which can not be affected, never changes since it does not participate in processes of dissociation and recombination. The reason then that it cannot be affected is that it is free from admixture.[2]

Thus Mind can not be affected because it is free from change, and it is free from admixture because it knows the homoeomeries; for he says that Mind can only govern—i.e. know the homoeomeries—if it is free from admixture. Indeed if it were composed of some type of homoeomerous matter, that matter would prevent it from knowing the other types of matter,[3] just as colored glass does not let other colors through because the predominant color does not allow the others to be transmitted.

528

Ibid. 840.5 (*On* 260b12)

Aristotle does not himself agree with this argument; here he is talking about Anaxagoras and Empedocles . . . and saying that according to them the fundamental type of change is change of place.

529

Commentary on Aristotle's ON PHYSICAL CHANGE[1] (*In Aristotelis Libros* DE GENERATIONE ET CORRUPTIONE *Commentaria*) 5.26

If the elementary types of matter transform into one another then they must have existed in one another either potentially or actually. If they exist in one another actually and thus transform into one another, physical change will involve the re-assembling of material components, as Anaxagoras and his school assumed.

530

Ibid. 11.5 (*On* 314a11)[1]

Aristotle leaves out the names of those who assumed that there is one elementary kind of matter, and includes those who say there are more than one, namely Empedocles . . . , Anaxagoras, who assumed the existence of an infinite number of homoeomeries, and . . .

531

Ibid. 11.13 (*On* 314a13)[1]

Aristotle has already said that for those who hold there are more than one elementary kind of matter in existing things it follows that coming to be is something else than qualitative change. Therefore he reproaches Anaxagoras for having improperly applied the words 'qualitative change' to physical change; for though he held that the homoeomeries—the numerically infinite basic constituents of matter in his theory—are not subject to changes of quality, and that physical change occurs when these homoeomeries dissociate and recombine—i.e. are extracted from one another, nevertheless, Anaxagoras called physical change qualitative change.

532

Ibid. 11.20 (*On* 314a15)[1]

Next Aristotle speaks about those who hold that there is more than one elementary kind of matter . . . Anaxagoras, and Leucippus and his school assumed that they are infinite in number. Anaxagoras posited the existence of homoeomeries. Aristotle adds the definition of 'homoeomery', saying that it is anything "whose subdivisions are designated by the same word as the substance in mass," for a piece of flesh is still flesh, and the same goes for bone and muscle as well, but the subdivisions of a hand and of other non-homoeomerous bodies are not designated by the same name as the whole, inasmuch as the subdivisions of the hand are not called 'hand' . . .

533

Ibid. 13.16 (*On* 314a24)[1]

Aristotle says that the theory of Anaxagoras concerning the elementary kinds of matter is diametrically opposed to that of Empedocles and his school. Empedocles says that the primary, simple, elementary types of matter are the four, and that homoeomerous substances like bone and flesh are formed when these four are combined. Anaxagoras on the other hand says that these four are compounds of homoeomeries, for he said that homoeomeries of bone, muscle, etc. exist in heat substance, clear liquid, etc. since he saw everything come to be from these things.

But still Anaxagoras held that there are homoeomeries of heat substance, colorless gas, clear liquid, and dry dust, as well as of bone, flesh and other things we call compounds, and that *all* things are in all things, and each thing seems to be and is called after the component which predominates in it numerically. Thus he was not really opposed to the opinion of Empedocles and his school; for Anaxagoras did not say that the four elementary kinds of matter are more composite than flesh, bone, etc. The difference between them is that Empedocles said that the four elementary kinds of matter are the building blocks out of which everything else is built up, while Anaxagoras said that the homoeomeries are the basic building blocks, and that each thing seems to be and is called after the component which predominates in it. In Anaxagoras' theory the only things which can be called compounds are non-homoeomerous bodies.

534

Ibid. 15.2 (*On* 314b8)

Alexander's interpretation is more natural. He says that the argument that physical change occurs in this way—that is, by dissociation and recombination—belongs to the theory which assumes the existence of more than one elementary kind of matter, because people who make this assumption must distinguish physical transformations from qualitative change . . . Anaxagoras too says that when the homoeomeries are separated from one another and combine with one another they make flesh or bone, and that flesh itself does not come to be, but rather appears when a large number of homoeomeries of flesh come together in the same place.

535

Ibid. 17.15 (*On* 314b15)

According to Anaxagoras the homoeomeries are modified by attributes.

536

Ibid. 18.23 (*On* 315a3)[1]

Aristotle has said that if one assumes the existence of only one basic kind of matter it follows that there is no distinction between physical change and qualitative change, and that if one assumes that there is more than one basic kind of matter it follows that one must recognize a difference between physical change and qualitative change; although those who held the latter position did not draw this conclusion themselves, nor did they distinguish physical change from qualitative change. In particular he reproaches Anaxagoras for not understanding the implications of what he said inasmuch as he called physical change qualitative change, and Empedocles . . .

537

Ibid. 24.6 (*On* 315b15)

. . . Those, like Democritus, Leucippus, Anaxagoras, and Empedocles, who posit the existence of more than one elementary kind of matter, hold that physical change is dissociation and recombination and not qualitative change . . .

538

Ibid. 127.4 (*On* 322b6)

Those who hold that only compounds of the elementary kinds of matter[1] can be created in natural processes say that processes of dissociation and recombination account for the way compounds are formed. Such people were Empedocles, Democritus, Anaxagoras, and their respective schools. They all held that the basic building blocks in their theories are not subject to change.

539

Ibid. 127.16 (*On* 322b6)

Each of them must introduce some factor which brings about the processes of dissociation and recombination . . . For Anaxagoras Mind is the factor which brings about dissociation and recombination.

540

Ibid. 192.14 (*On* 327b27)

. . . With these words Aristotle is censuring Anaxagoras and his school, who say that all things in the universe were once together . . .

541

Ibid. 281.25 (*On* 335a22)

Plato in the *Phaedo*[1] . . . chides the others for not talking about a factor responsible for fashioning all things. He speaks well of Anaxagoras in the same place because Anaxagoras said that Mind is such a factor, though even he did not use it to explain processes of physical change . . .

542

Ibid. 285.8 (*On* 335b7)

When he talks about a 'third factor' Aristotle is referring to a factor responsible for fashioning all things. He is alluding to Anaxagoras and Plato; for Anaxagoras, although he said that Mind is such a factor, does not use it to explain physical change.

543

Commentary on Aristotle's ON THE INANIMATE WORLD *(In Aristotelis* METEOROLOGICUM *Librum Primum Commentarium)*
16.17 (*On* 339b21)[1]

Aristotle approves of Anaxagoras' name for the upper regions, but chides him for having thought that aether is called 'aether' from *aithein*—i.e. 'burning'—for he held that the regions above the earth—i.e. the heavenly regions—are filled with heat substance.

544

Ibid. 75.21 (*On* 342b27)[1]

Anaxagoras and Democritus are certainly talking about a conjunction of all the five planets. These planets are the heavenly bodies named for Saturn, Jupiter, Mars, Mercury, and Venus. They did not include the sun and the moon, for they would assuredly have rendered their theories false. They say then that when these planets come close to one another and seem to touch—for they certainly do not touch, since they are not in the same plane—they appear to be quite large, and are seen as one body; that is, one beam of light appears, made up of the light of all of them together. It is my opinion that if anyone asked them why comets appear to be larger at one time than at another they would say that when the planets are close together the comet appears smaller, and that when they are farther from one another and not extremely close it seems larger. This is especially so when some of the fixed stars are near by and add their light to that of the planets. If we asked why comets sometimes have one shape and sometimes another, they would again say that the different relative positions of the planets account for this, that is, whether some of the planets lie vertically while others lie horizontally, some more toward the south and others more toward the north, or whether they differ in any other way in their relative positions.

545

Ibid. 103.1 (*On* 345a25)[1]

The third theory about the Milky Way which Aristotle discusses is the following: He says that at night when the sun is under the earth its light evidently reaches some stars above the earth and does not reach others. Those it reaches it masks, because the intensity of its light is greater than theirs. Thus these stars are not visible, just as during the day all the stars which are above the earth are masked by the sun's light so that we see none of them. However the light of those stars which the sun's rays do not reach, because the earth is in the way, is not masked by the sun. It is this light which is called the Milky Way.

546

Ibid. 123.18 (*On* 348a20)[1]

This and what follows constitute the refutation of Anaxagoras' theory on the grounds, stated in this passage, that it contradicts the observed facts. For hail has not been observed at high altitudes. If Anaxagoras' theory were true hail would be formed there, since that is where he says the clouds are thrust. However it seems that it is snow which falls on very high mountains. Therefore Anaxagoras' theory is false and does not agree with observed phenomena.

547

Ibid. 123.27 (*On* 348a23)[1]

This passage too attempts to show that hail is not formed far from the earth, as Anaxagoras thinks.

548

Ibid. 124.28 (*On* 348a30)[1]

The preceding passage proved that hail is formed close to the earth and not, as Anaxagoras and his school have it, at higher altitudes. If hail originated at higher altitudes because it is colder there, the hail would have to be greater in intensity and the hailstones larger in size the higher their place of origin; for the closer something is to the conditions which produce it the greater it is. As it is however the opposite seems to be true, since it seems that more violent hailstorms with a greater number of hailstones fall at lower altitudes. Furthermore, hailstones are asymmetric because they have not been worn down in their fall, not having traversed a great distance. Having refuted Anaxagoras' theory in this way, Aristotle goes on to propose his own theories on this subject.

549

Ibid. 127.27 (*On* 348b12)

Our assumptions, Aristotle says, are opposed to those of Anaxagoras. Anaxagoras says that a cloud turns into hail when it reaches high altitudes where it is cold, and we say the opposite . . .

550

Commentary on Aristotle's PSYCHOLOGY[1] (*In Aristotelis* DE ANIMA *Libros Commentaria*) 72.9 (*On* 404a29)[2]

Anaxagoras however sometimes seems to distinguish between Mind and life, and sometimes to equate them. When he says that Mind is a power responsible for order in the universe he distinguishes Mind from life; for Anaxagoras implies that there are things which are not properly ordered and that some other power—namely, life—is in control of these, when he says that Mind is responsible for order in the universe, Mind being more divine than plain life. In other places however he seems to confuse these two things and to equate life with Mind, for example, when he says that Mind is in all animals, large and small, honorable and base. However Mind proper—that is, Mind in the sense of intelligence—does not seem to belong to all animals. Why should I limit myself to animals? It is not even apparent in all men! Thus when Anaxagoras said that Mind is in all animals he could as well have said 'life.'

All these thinkers assume that movement is a characteristic of life, but "Democritus is entirely different." Unlike Democritus who clearly always equates mind and life, Anaxagoras, as we have said, sometimes identifies the two and sometimes distinguishes between them. "For Democritus does not associate the mind with the capacity for conceiving truth." The fact is that mind is the faculty of the living being by which it apprehends truth; Anaxagoras and Democritus however equate life with mind.

551

Ibid. 82.4 (*On* 404b30)

Thus each thinker has a different conception of the nature of life. All of them however say that it consists of the components they conceive to be basic to all existing things. In particular, those who stress the faculty of knowledge and perception as characteristic of life say that life consists of the elementary components of matter, except for Anaxagoras, as Aristotle will point out in what follows.

552

Ibid. 82.20 (*On* 404b30)

Empedocles and Anaxagoras use both material and nonmaterial primary entities in their theories . . . Anaxagoras includes Mind in addition to the homoeomeries in his theory.

553

Ibid. 85.17 (*On* 405a13)[1]

Where Anaxagoras said that Mind is responsible for order in the universe—implying that there is something else, i.e. really life, responsible for things which are not properly ordered—he seems to distinguish Mind from life. Indeed a living being, inasmuch as it comes to know things by reasoning from premises to conclusions, is liable to err if it assumes something false as one of its premises. Mind however comprehends things directly, as Aristotle himself says, and either knows or does not know. Therefore it can not err, for if it erred Mind would be mindless; but this would be absurd. It seems that Anaxagoras distinguishes between Mind and life for these reasons. However where he said that Mind is the source of motion and change in the universe, and that it can be observed in all animals large and small, honorable and base, Anaxagoras identified Mind with life. For it is a function of life to impart motion, and it is life, not Mind, which can be observed in all animals.

554

Ibid. 85.32 (*On* 405a15)[1]

Anaxagoras says that Mind bears the primary responsibility for all things. Certainly he means that it brings everything about. Aristotle praises him for this and also for having assumed that Mind is simple and free from any admixture of matter, unlike the homoeomeries, which are all mixed in each other; Anaxagoras says instead that Mind is free from admixture, pure, and simple.

555

Ibid. 91.9 (*On* 405b12)[1]

Aristotle says that Anaxagoras alone did not tread the same path as the others. They said that the mind must be made up of the elementary components of matter since its function is to know and perceive, while he equated Mind with life; for the characteristic activity of life is movement and change, and Anaxagoras said that the characteristic activity of Mind is to originate motion and change in the universe. Thus he equated Mind with life, and said that this Mind is pure, free from admixture, and not subject to change—i.e., that it is not material. He said that the homoeomeries are the basic components of existing things and are mixed with one another, while he said that Mind is not mixed with them but is pure, thus implying that it is different from the basic building blocks of all things. Thus the path Anaxagoras trod is not the one all the others walked. Accordingly Aristotle accepts Anaxagoras' statement that life is incorporeal, but says that he is wrong in the account he gives of life. For, as Aristotle says, if Mind is free from admixture, and has nothing in common with the basic building-blocks which make up all things, and bears no relation to them, it is not clear how it can come to know all things. Anaxagoras himself has not told us how, nor can it be inferred from his writings.

556

Ibid. 91.27 (*On* 405b23)[1]

Often the ancient authors did not express themselves in explicit terms. Still it is possible to infer the drift of their argument from their words, as did Aristotle when he inferred that Democritus and Anaxagoras equate life with the mind.

557

Ibid. 185.16 (*On* 410b21)

Aristotle's assumption here is that those who hold that life is characterized by the ability to know and perceive identify life with perception and with the mind, and hold accordingly that life is compounded out of the elementary kinds of matter in the universe. Democritus says this clearly, and Anaxagoras too seems to imply it.[1]

558

Ibid. 522.29 (*On* 429a18)[1]

Aristotle says that if the mind is to be able to comprehend everything one must assume it to be free of any admixture of matter, because if it were made up of matter it would not be able to perceive matter—evidently for the same reason that the organ of touch can not perceive a warm object which has the same temperature it does. For this reason too Anaxagoras says that Mind is not made up of the homoeomeries which he says compose everything, in order that it may master all things—by which he means, in order that it may know all things. For 'master' for Anaxagoras is 'know' for Aristotle. It is correct for him to say that nothing can come to know the things which compose it, for he holds that anything which perceives must be different from that which is perceived.[2]

559

Ibid. 526.22 (*On* 429b10)

. . . Aristotle and Anaxagoras . . . say that Mind is not mixed with matter.

560

An Essay against Proclus, On the Eternity of the Universe (De Aeternitate Mundi Contra Proclum) 4.11

. . . In this way we unwittingly introduce the argument of Anaxagoras who said that no object has any particular characteristic, but that the nature of each substance is determined by the proportion of its own substance to the substance of all other things in it. Plato and Aristotle have shown this theory to be entirely false.

561

Ibid. 6.20

Plato knew that some of the natural philosophers before him had thought that the world was created at some particular moment and is not eternal, although almost all of them, except one, were ignorant of the factor responsible for fashioning the world and spoke only of material factors, as if matter takes on its properties and its organization all by itself. Anaxagoras alone, waking as it were from a sleep—as Plato himself says—said that Mind is in control of the universe and made Mind responsible for the creation of the world.

562

On the Creation of the World (De Opificio Mundi) 2.13

It is laughable for Anaxagoras to assume that the building blocks of things are homoeomeries. He said that all things are in all things, and that each thing is called after the component which predominates in it. For example, in any piece of flesh there is every simple type of matter and every compound, and similarly there are all things in bone, gold, bronze, heat, water, and once and for all in everything, even in the smallest existing thing. Anaxagoras held that things are only re-arranged and nothing really undergoes physical change. An illustration of this theory is afforded by a heap of mixed grains which is mostly barley. If someone separated out of it grains of wheat one might say that wheat was coming to be out of barley. It would not however be true creation, but only the separation of a particular type of grain, and not even complete separation at that.

BOETHIUS

c. 480–*c.* 524 C.E.

563

The Consolatory Value of Philosophy (De Consolatione Philosophiae)

1. Prose 3.9

But if you have never heard of Anaxagoras' exile, of Socrates' poison, and of Zeno's torture, because these men are not Romans, yet certainly you might be expected to know the Canii, the Senecas, the Sorani . . .

DAMASCIUS

c. 480–middle of sixth century C.E.

564

Studies in Plato's PARMENIDES' LOGICAL EXERCISE *(Dubitationes et Solutiones de Primis Principiis in Platonis* PARMENIDEM*)*

134 (*On* F221 Gamma)

Let me remark . . . that Plato informs us here that Anaxagoras introduced into his theory Mind, which is unchanging. However it is not certain that Anaxagoras thought of Mind this way. Elsewhere Plato says he thinks Anaxagoras' Mind is an unbounded[1] spirit.

ASCLEPIUS OF TRALLES

sixth century C.E.

565

Commentary on Aristotle's FOUNDATIONS OF SCIENTIFIC THOUGHT, (*Commentarius In Aristotelis* METAPHYSICORUM *Libros A–Z*) 4.26 (*On* 980a22)

In Book I Aristotle . . . , agreeing with Plato, shows that matter is not really the most important element in a physical theory. This is why Aristotle commends Anaxagoras; for while the other philosophers were asleep, he says, Anaxagoras alone arose from a deep sleep as it were and recognized that Mind rules over the universe like a king.

566

Ibid. 25.25 (*On* 983a24)[1]

Anaxagoras of Clazomenae, who was older than Empedocles, was "later in his activity"[2] because Empedocles assumed that there are a finite number of elementary kinds of matter, saying that there are four, while Anaxagoras held that there are an infinite number. How is it possible however to construct a scientific theory about the basic kinds of matter if they are infinite? One can not know anything about infinity. Anaxagoras held that all the homoeomeries—for example, water and heat—are created and are destroyed; for he says that both water and heat are composed of homoeomeries. Anaxagoras also held that creation involves the coalescence of matter. When he said this he meant that nothing is destroyed or is created, but everything endures eternally, since after the dissociation of an object the same matter which composed it can be found elsewhere, as it could be before it coalesced also.

567

Ibid. 26.18 (*On* 984a27)

. . . Anaxagoras and Empedocles and their respective schools speak of factors which fashion all things . . . Aristotle will speak of them later.

568

Ibid. 28.7 (*On* 984b1)[1]

Anaxagoras however saw Mind in plants, in animals, and in all of nature. He said that Mind fashioned the world and is responsible for all order; and he "was like a sober man among stammerers," that is to say, among drunkards. In his detailed investigations however he reverted to using the homoeomeries in his explanations of phenomena. "We know with certainty that" among the natural pholosophers "Anaxagoras said this," that is to say, said that Mind is in control of the universe.

569

Ibid. 29.22 (*On* 984b23)

. . . Anaxagoras introduced into his theory a factor responsible for perfection in the world in the guise of the factor which makes everything what it is . . .

570

Ibid. 29.34 (*On* 984b23)[1]

It remains to be determined who first introduced this concept: Anaxagoras (as it seems), Hermotimus, Hesiod, Parmenides, or some other earlier thinker.

571

Ibid. 31.15 (*On* 985a10)

Aristotle says that he has mentioned[1] that Empedocles, Anaxagoras, and also Hermotimus, as well as the poets Hesiod and Parmenides based their explanation of the universe on two factors: matter, and the factor which fashions all things . . .

572

Ibid. 31.25 (*On* 985a10)[1]

. . . Thus we see that these men too . . . introduced the two basic concepts in their theory by pure chance, unscientifically. Anaxagoras is especially guilty of this; for whenever he was at a loss for an explanation he said that Mind causes all things. However when he came to particulars, as Plato too says in the *Phaedo*,[2] he never mentioned Mind and in a completely unscientific manner cited only the behavior of matter in his explanation. Instead he should have introduced Mind everywhere and shown consistently that it is responsible for all things. . . . Aristotle says that Anaxagoras uses Mind as a *deus ex machina* in the way that gods are introduced into tragic dramas on a machine, to resolve impossible situations, as Artemis appeared to Theseus when he had no way out in the *Hippolytus*. Similarly when Anaxagoras can not explain what caused the world to be created he drags in Mind; but in explaining detailed phenomena he cites any other reason rather than Mind.

573

Ibid. 33.8 (*On* 985b4)

Having reviewed the theories of Empedocles and Anaxagoras, Aristotle next . . .

574

Ibid. 43.2 (*On* 987a4)

Some other thinkers however, like Empedocles, Hermotimus, and Anaxagoras, talk about something, in addition to matter, responsible for fashioning things. Some spoke of Mind, others of Repulsion and Affinity.

575

Ibid. 53.6 (*On* 988a14)[1]

Having said that Plato discussed the factor which fashions all things . . . Aristotle reminds us that more ancient philosophers, like Empedocles, Anaxagoras, and their respective schools, talked about such factors . . . For Anaxagoras, Mind alone fashions all things, those which are perfect and also those which are completely defective.

576

Ibid. 53.29 (*On* 988a18)[1]

"Anaxagoras" assumed that "matter is composed of an infinite number of homoeomeries," thus assuming that matter is corporeal.[2]

577

Ibid. 54.4 (*On* 988a18)[1]

Some other thinkers talk about something, in addition to matter, which is responsible for fashioning things, e.g. people like Empedocles, who speak of Affinity and Repulsion, like Anaxagoras, who speak of Mind, . . .

578

Ibid. 55.7 (*On* 988a34)[1]

Anaxagoras, who spoke of Mind, and Parmenides, who spoke of Love, held that each respectively is perfect and responsible for perfection in other things. They did not however say that they are final states towards which all physical processes tend; rather for these thinkers they are factors responsible for fashioning things.

579

Ibid. 61.3 (*On* 989a30)[1]

Aristotle says that Anaxagoras assumed two basic elements in his theory—Mind, which fashions all things, and the homoeomeries, which compose the matter in all things—and that Anaxagoras said that all things in the universe were mixed together. However it is impossible for all things in the universe to be actually mixed with one another, for then they would exist before coming to be. Then too a straight line and whiteness, or music and a straight line, would be mixed. This is impossible since all things are not suited by nature to mix with all other things. Again, things which are mixed must have existed independently before being mixed, so that if attributes too were present in the mixture they would have had to exist independently apart from objects. This too is impossible.

Certainly then, Anaxagoras, you must have meant these things figuratively, and when you said that all things in the universe were mixed together you must have intended to refer to pure matter, in which all things do in fact exist. Otherwise, you must really have been indulging in wild fantasy when you described matter as you did.

Since Anaxagoras observed that all things come to be from all things, and did not observe how they pass back into pure matter, he declared that all things are in all things in actuality. This is impossible however; for all things are in all things potentially, but not actually. Certainly then, if Anaxagoras had found some helping hand to formulate his theory it would have come out right, as our philosopher says.

580

Ibid. 61.20 (*On* 989a30)[1]

Someone who held that Anaxagoras' theory involves two basic elements—Mind and the homoeomeries—would not be saying anything unreasonable. For though Anaxagoras himself did not state this explicitly, as we said above, still it follows if his words are formulated clearly. Indeed if we interpret his theory along the lines we have indicated it will follow that all things exist in all things potentially, and not in actuality. "Of course it is absurd to say that in the beginning all things in the universe were mixed" for the reason we have given, and also because things which are mixed must have existed separately before being mixed, so that the state of being mixed can not have been the first state to exist. Furthermore, everything can not be mixed with everything else in the universe; for how could a straight line and whiteness be mixed, or a musician and whiteness? In addition it would follow for anyone who held this theory that attributes and qualities could be separated from objects and exist independently since, if things can be mixed, they can be separated.

Therefore if these too could be mixed (and indeed "all things" must include attributes and qualities) then they could also be separated, and qualities could exist independently. This is impossible.

Aristotle improves Anaxagoras' theory and reformulates his words, saying, "if someone were consistently to spell out what Anaxagoras wanted to say, he would doubtless find that Anaxagoras was quite an original thinker." Indeed it is clear that pure matter can not be made up of actually existing distinct entities, since if it were it could never have taken on the properties of anything else . . . and thus "no predicate could be applied to the mixture before anything had been separated out: it could not have been any color, like white, black, gray, etc., but had to be colorless." It would only later receive color, but it would not have been able to, if it had already had any specific color . . . "Similarly, it was tasteless" since it would only later receive all tastes. Therefore unformed matter in its original state without properties is nothing specific, not a quantity, not a place, and not any other predicate.

Aristotle goes on to explain how somebody can go through Anaxagoras' words meticulously and reformulate them. Because nothing existed separately or was actually independent it is clear that no definite predicate could validly be assigned to that substance—i.e. to the mixture of which he spoke. Thus it was not possible to predicate of it white, black, gray, or any other predicate of color, any taste, any quality at all, any quantity, or any other definite predicate; for if any of these predicates had belonged to the mixture he talked about, something in the mixture would already have had independent and actual existence. This would have been impossible if all things had really been mixed together, for any given independent entity would not have been in the mixture. Anaxagoras however said that all things were mixed except Mind, which is the one thing free from admixture and pure.

581

Ibid. 62.21 (*On* 989b16)[1]

Aristotle presents a summary of Anaxagoras' theory concerning the basic nature of the universe in the way it would have been written had Anaxagoras' meaning been formulated in a consistent manner. According to Anaxagoras, everything in the universe is accounted for by Mind, which is simple, according to him, and free from admixture (it would be analogous to the 'one'), and by the 'other', i.e. by unformed matter. Indeed before matter received definite specific properties it was unformed: it contained none of those things which it can actually become; it was entirely potential. This is how Anaxagoras conceived the mixture to be. "These things are not stated explicitly or clearly"; however even if Anaxagoras had said what Aristotle makes him say in his attempt to help him to say what he really intended, Anaxagoras would not be quite correct. For Anaxagoras would surely say that there are only two basic entities in the world, rather than four. Moreover it is not possible to maintain that this is what he really meant to say; for he seems to have said that the homoeomeries were *really* in the mixture, not potentially there. On the other hand Anaxagoras never expressed his meaning clearly. "Still Anaxagoras' words imply views which resemble those of later thinkers"—that is, Plato and his school, who posit two things which underlie all existing things, the 'one', and the 'undefined' . . .

582

Ibid. 63.17 (*On* 989b21)[1]

At any rate, though Anaxagoras said that Mind is incorporeal, still he does not discuss particular incorporeal entities such as life and the rest.

583

Ibid. 86.9 (*On* 991a14)[1]

Aristotle is saying that Anaxagoras and Eudoxus . . . and their respective schools . . . held that all things are in all things, and that flesh, or a white object, or anything else of this kind is named after the component which predominates in it. However, many contradictions arise if one says this. If all things are mixed in all things it follows that attributes and predicates existed independently before being mixed, which is impossible. Anaxagoras and his school assumed that homoeomeries are the basic building blocks of everything that exists. He adds that those who hold that all things are mixed in all things are to be preferred to those who speak about pure predicates . . . "This view, first proposed by Anaxagoras and later held by Eudoxus and others is easily overthrown. For it is easy to show that many absurdities follow from such an opinion" which holds that all things are mixed together.

584

Ibid. 111.20 (*On* 993a11)

. . . Others, namely Anaxagoras and Empedocles, spoke of two basic elements necessary to an explanation of nature. In addition to matter they included in their theories a factor responsible for fashioning things . . .

585

Ibid. 112.11 (*On* 993a22)

Aristotle says that if one lent a helping hand to Empedocles . . . his theory would be satisfactory and reasonable . . . ; which is what Aristotle said above concerning Anaxagoras when he reformulated Anaxagoras' theory. There Aristotle said that Anaxagoras' theory would have been logical if someone else had stated it, but Anaxagoras himself did not formulate it clearly.

586

Ibid. 267.29 (*On* 1007b21)[1]

. . . Then the teaching of Anaxagoras that all things are together—i.e. actually—would follow . . . Thus it seems that the followers of Protagoras do the same thing as Anaxagoras: they too say fantastic things about matter . . .

587

Ibid. 275.17 (*On* 1009a22)[1]

. . . Anaxagoras said that all things are mixed in all things . . .

588

Ibid. 277.27 (*On* 1009b9)[1]

Some of Anaxagoras' friends told of his remarking that things are for each person as they appear to him to be. We say on Anaxagoras' behalf that this means that if a person lives his life relying only on his senses he will act accordingly, but if he lives his life relying on his intellect it is clear that he will act intelligently.

589

Ibid. 292.23 (*On* 1011b15)[1]

Next Aristotle turns to certain theories, such as those of Heraclitus and Anaxagoras, refutes them, and tells that their authors were led astray because they could not solve apparently insoluble problems . . . Since Anaxagoras observed that everything comes to be from everything, and since he did not notice that objects pass back into pure matter, he said that everything is mixed with everything. Therefore according to him anyone who makes a definite statement is lying since, for example, black is in white, and so forth.

590

Ibid. 298.2 (*On* 1012a17)[1]

The difficulty which led people to say that something exists whose properties lie between extremes is the following: something can not come to be out of nothing, but objects with different properties are observed to arise out of one and the same thing; and so they must have existed in it previously . . . and the object itself must have properties which lie somewhere between those of the things which arise from it . . . This was the way Anaxagoras too reasoned.

591

Ibid. 298.30 (*On* 1012a21)[1]

Anaxagoras holds "that the properties of any object lie between the extremes of contrasting qualities"; for if some components of the mixture are perfect and the rest are completely defective, the mixture is neither perfect nor not perfect and neither completely defective nor not completely defective. Therefore all things are false since all things are in all things, by which Anaxagoras means that contrasting properties exist in one another.

592

Ibid. 299.4 (*On* 1012a29)

. . . "Those who say that nothing is true," like Anaxagoras . . .

593

Ibid. 345.10 (*On* 1023a19)

. . . The poets say Atlas holds up the heavens, while the natural philosophers like Anaxagoras say the vortex alone holds them up.

594

Ibid. 377.28 (*On* 1028b2)

Some people like Leucippus, Democritus, and Anaxagoras say that there exist an infinite number of basic constituents of the universe.

LYDUS

c. 490–past the middle of the sixth century C.E.

595

The Months of the Year (De Mensibus) 3.12

Anaxagoras and Democritus hold that the moon is a fiery solid body with plains, mountains, and gullies on it.

596

Ibid. 4.107

Concerning the rising of the waters of the Nile in the summer, Anaxagoras says that the snows which melt in Ethiopia are the source of the Nile. Aeschylus, Sophocles, and Euripides are of this opinion too, but the greatest of the Roman philosophers, Seneca, disagrees . . .

597

The Art of Divination (De Ostentis) Prooemium 7

It is not at all to be wondered at that men foretell the future, for Nature itself presages events. This is probably what happened in the seventy-eighth Olympiad[1] when Anaxagoras prophesied that a huge stone would fall from the sun, something which actually occurred later in Thrace. The stone still exists and from its appearance it is clear that it was once aflame. Apuleius says the same thing happened near Abydus and Cyzicus and that the people there still have a stone which is of a burnt color and all streaked with iron. The citizens of Cyzicus have a tradition that their city will last as long as the stone.

OLYMPIODORUS

sixth century C.E.

598

Commentary on Plato's ON LIFE AFTER DEATH (*In Platonis* PHAEDONEM *Commentaria*) p. 59.12 (*On* 70c)[1]

If all distinctions are erased through the coalescence of all things, in time all things will have come together and Anaxagoras' statement "all things in the universe were together" will come true.

599

Commentary on Plato's ON THE EDUCATION OF A STATESMAN (*Commentaria in Platonis* ALCIBIADEM I) 135.21 (*On* 118b)[1]

Pericles learned philosophy from Anaxagoras . . .

600

Ibid. 137.20 (*On* 118c)[1]

Pericles learned the science of government from Anaxagoras. Anaxagoras was the first to introduce Mind into his theory of the universe as a transcendent power in control of the things below it, not as one of their number. In the same way Pericles could not be compared with the mass of humanity, but he ruled over them and became, as it were, their Mind.

601

Ibid. 214.14 (*On* 130d)

I shall apply to divine matters what Anaxagoras said: All things are in all things and one thing predominates.

602

Commentary on Plato's ON RHETORIC (*In Platonis* GORGIAM *Commentaria*) p. 76.20 (*On* 465d)[1]

Anaxagoras considered the homoeomeries primary. He observed that all things come into being from all things. However, not being able to prove by actual subdivision that all things are in all things, he used theoretical arguments to conclude that all things were together. Accordingly Plato is saying that if the body were to judge corporeal things, all things would be in all things, i.e. there would be confusion. Plato is in effect saying, "I say these things to you, Polus, since you are well-versed in the doctrines of Anaxagoras." It is necessary to understand that Gorgias was an Empedoclean, while Polus accepted the theories of Anaxagoras.

603

Commentary on Aristotle's ON THE INANIMATE WORLD (*In Aristotelis* METEORA *Commentaria*) 17.17 (*On* 339b2)[1]

The regions which reach till the outer sphere appear to consist entirely of colorless gas, because they are invisible. The stars appear to be fiery, but everything else in these regions seems to be all colorless gas. For the colorless gas, as well as the sphere of burning heat and the other spheres, is invisible, while the stars alone are fiery. Indeed Anaxagoras called the sun '*mydros*',[2] because of the huge quantity of fire in it; for *mydros* means iron which has been heated red-hot. Anaxagoras was ostracized by the Athenians for having had the audacity to say this, but he was later recalled thanks to the rhetorical skill of Pericles; for Pericles happened to be a student of Anaxagoras.

604

Ibid. 20.27 (*On* 339b16)[1]

Anaxagoras used this word,[2] but he was not right about its etymology; for he said the upper regions are called '*aithēr*', from *aithein*, i.e. burning. We too call dry black wine[3] *aithops*.

605

Ibid. 52.26 (*On* 343a20)

Thus a comet must be a planet, as Pythagoras and Hippocrates say, or a conjunction of all the planets, as Anaxagoras and Democritus hold . . .

606

Ibid. 66.27 (*On* 345a11)[1]

Two of the four incorrect theories explaining the Milky Way are Pythagorean, one of the others is Anaxagoras', and the fourth is Hippocrates'.

607

Ibid. 67.33 (*On* 345a11)[1]

The third theory is that held by Anaxagoras and Democritus. They say that the Milky Way is the light of stars not lit up by the sun. For they say that the heavenly bodies have their own light, and receive additional light from the sun. The moon illustrates this. To be sure its own light is different from the light it receives from the sun. The moon's own light is like the light of glowing coals, as is apparent from that part of it which does not shine. However, they say, not all the stars receive additional light from the sun, and those which do not, compose the band of the Milky Way.

608

Ibid. 92.9 (*On* 348a14)[1]

Before giving his own explanation Aristotle gives Anaxagoras', and after having refuted Anaxagoras' views he goes on to add his own explanation. Anaxagoras said that hail falls in warm seasons and in warm places, because it requires a great amount of heat to draw the vapor up and carry it to higher altitudes, where hail can then form when the vapor reaches the cold regions far from the earth. This is Anaxagoras' explanation. It leads to three incorrect conclusions, Aristotle says. First of all, hail does not form far from the earth, but close to the earth. The proof of this is that snow appears on the peaks of mountains, but hail does not. Second, low clouds sometimes appear accompanied by very loud thunder—so loud that people are amazed and think something terrible is happening—and hail falls shortly after. This proves that hail forms at low altitudes. Third, the hailstones that fall are not spherical but elongated, not small but very large, and they fall not in dense concentrations but very lightly. All this proves first that hail is not formed at high altitudes, and second that it is formed at lower altitudes. Hailstones which fall a great distance are spherical because their rough edges are worn away; and they are also small because they are worn down; and they fall in dense concentration because many of them fall. Therefore since in warm weather hailstones are in fact large and elongated and fall in light concentrations it is clear that Anaxagoras must have been wrong. Having refuted Anaxagoras' explanation in this way, Aristotle goes on to give his own.

609

Ibid. 94.20 (*On* 348a14)

"Some people"[1] refers to Anaxagoras and his school.

610

Ibid. 94.22 (*On* 348a20)[1]

"As it happens, hail rarely falls at high altitudes." This begins Aristotle's refutation of Anaxagoras' theory.

611

Ibid. 95.4 (*On* 348a36)[1]

"It is clear then that the freezing does not take place because the cloud is thrust into the cold high altitudes." This is the logical conclusion which follows from the impossible consequences of Anaxagoras' theory.

SIMPLICIUS

sixth century C.E.; wrote after 533 C.E.

612

Commentary on Aristotle's PHYSICS *(In Aristotelis* PHYSICORUM *Libros Commentaria)* 7.3

Anaxagoras of Clazomenae said that Mind is in control of all things and is the factor responsible for fashioning things. However, he rarely used Mind when giving explanations for phenomena, and for this he was taken to task by Socrates in the *Phaedo*.[1] Nevertheless perhaps Anaxagoras' position is reasonable.

613

Ibid. 8.1

All the others omitted to include any factor responsible for fashioning things. Only Anaxagoras and Plato, and also the Pythagoreans, identified this factor with a supernatural Mind.

614

Ibid. 21.15 (*On* 184b15)

Those who investigated the basic concepts with which all things can be understood assumed, when they looked for them, that such concepts do exist. Some of these thinkers did not distinguish between natural and supernatural entities. Others, such as the Pythagoreans, Xenophanes, Parmenides, Empedocles, and Anaxagoras did make this distinction, although most people do not realize that they did because these writers are not clear.

615

Ibid. 22.3 (*On* 184b15)

It is important to know that . . . when Aristotle sets out to refute the so-called physicists he distinguishes among them in the following way: either they say that only one thing—namely, a basic kind of matter—exists, or they say that there exist many things in addition to the universe as a whole . . . Anaxagoras and Empedocles are the ones who say that there exist many things in addition to the universe as a whole.

616

Ibid. 24.23 (*On* 184b15)

Anaximander says that physical change occurs not when the one basic kind of matter undergoes qualitative change, but when different qualities are separated from one another as they move about ceaselessly. Therefore Aristotle has classed him together with Anaxagoras and his followers.

617

Ibid. 25.1 (*On* 184b15)

Diogenes of Apollonia took most of what he wrote from others, adopting some things from Anaxagoras, and other things from Leucippus.

618

Ibid. 25.19 (*On* 184b15)

. . . Empedocles of Acragas, who was born not long before Anaxagoras . . .

619

Ibid. 26.31 (*On* 184b15)

Some of those who say that the basic components of the universe are infinite in number hold that they are simple and all of one kind; others hold that they are compounds, not of the same kind, and indeed altogether different in their properties, and characterized by their predominant component. Anaxagoras, the son of Hegesibulus of

Clazomenae, and a student of Anaximenes, was the first to introduce a new feature into the study of the basic concepts with which natural philosophy must begin, adding the factor which was missing.

Anaxagoras said that the basic kinds of matter are infinite. He held that all homoeomerous substances like water, heat, or gold are neither created nor destroyed, but only appear to be created and destroyed when they are dissociated and recombined; for all things are in all things and each thing is characterized by its predominant component. Thus, for example, an object which contains mostly gold matter appears to be gold, although all kinds of matter are in it. Anaxagoras says: All things contain something of everything, and the predominant component in any particular object always comes to view and determines what the object is. Theophrastus says that these views of Anaxagoras are very close to those of Anaximander, since Anaximander says that substances of similar nature come together when they are separated out of the infinite universal mass and become distinct from one another. Thus the gold already in the universe becomes a piece of gold, the earth, a piece of earth, and so for each object; for nothing participates in processes of physical change except things already in existence. Anaxagoras said that Mind controls all motion and physical change, and that it is the factor responsible for forming all things that make up worlds, and everything else, by assembling their components.

Theophrastus says: Also, if we assume these things, it might seem that Anaxagoras held the basic building blocks of matter to be infinite in number, and that there is only one source of motion and of change, viz. Mind. If however one assumes that the universal mixture is a single entity, of indeterminate properties and size, it follows that he means that there are two basic entities in the theory, namely, the infinite substance, and Mind. Accordingly Anaxagoras seems to follow closely Anaximander's treatment of the basic building blocks of matter.

620

Ibid. 34.18 (*On* 184b15)

It seems that Anaxagoras' theory involved a threefold order: First is a unified realm of order similar to the unity brought about by pure thought, of which he says: All things in the universe were together, infinitely many and infinitely small. And again he says: Before different things were separated out of the universal mixture, no color could be discerned in it; for the blending of all things—wetness and dryness, heat and cold, brightness and darkness, together with a great amount of earth and an infinite multitude of completely dissimilar particles—made discrimination impossible. Accordingly we must conceive all things in the universe to be one, so that this universe would be the one existing thing of which Parmenides speaks. The second is a diversified realm of order similar to the capacity of intellect to make distinctions, to which the existence of many distinct objects in the world corresponds. Thus, not far from the beginning of his first book on Nature, Anaxagoras says: Therefore one must conceive that many different kinds of things, particles of all substances, possessing all features, colors, and tastes, are united into one[1] in the universal mixture of all things. And men and all other animals—those things which have life—were formed. And these men had incorporated towns and suitable employment, just as we have. And they had sun, moon, and other heavenly bodies, just as we have. The earth brought forth for them a wide variety of produce, the finest of which they gathered into their homes and put to use. This passage about the separation explains, then, that things were formed by being separated out not only here, but elsewhere as well. Some people may think that Anaxagoras is drawing a parallel between the other parts of the earth and the regions we inhabit, rather than pointing out the similarity between the formation of many distinct objects when change takes place, and the capacity of intellect to make distinctions. However if he were talking about other places on earth he would not have said that they had sun, moon, and other heavenly bodies, just as we have; and he would not have referred to entities in those places as particles and shapes of all things.[2] Indeed when he draws a parallel between the two a bit further on he says: Things being churned and divided from one another because of force and speed[3]—speed gives rise to force; and their speed can not be compared with the speed of any object known today, but is many, many times greater. This then is what he really meant.[4] Therefore when he says that all things are in all things he means first that all things are in all things as they are when they are unified in pure thought; second, as they are when the intellect is able to conceive many distinct objects together; and third, as they are commonly observed to be when perceptible objects are seen constantly to arise out of and disintegrate into the same component parts.

621

Ibid. 40.28 (*On* 184b16)[1]

It is common practice to identify a person by the subject to which he was wholly or mostly devoted. Thus . . . Thales, Anaximander, Anaximenes, Anaxagoras, Democritus, and such people were called physicists.

622

Ibid. 43.26 (*On* 184b20)[1]

All the commentators agree with Aristotle that Democritus believed that the basic components of the universe are all of the same nature, and that these atomic components are made up of one kind of matter, differing in shape and in the properties which depend on their shape. Porphyry and Themistius think that the phrase "or even of matter having contrasting properties" refers to Anaxagoras' theory and is parallel to the phrase "as Democritus would have it." Among those who assumed that the basic components of the universe are infinite in number, Democritus and his school held that these components are atoms made up of one kind of matter—in agreement with his theory of one kind of filled space[2]—and that they differ in shape, orientation, and order; while Anaxagoras and his school held that the basic components of the universe consist of matter having contrasting properties. The latter assume that heat and cold, dryness and wetness, rarity and density, and all other pairs of contrasting qualities are in the homoeomeries, and that these homoeomeries, which for them are the basic components of all things, differ with respect to their properties. For their theory holds that the basic kind of difference is one of quality rather than shape.

Alexander of Aphrodisias rejected this interpretation and held that the entire sentence refers to Democritus. . . . Alexander's interpretation implies that one has only two alternatives to choose from: either the text is corrupt, so that the words "or else," which introduce a second view parallel to that of Democritus, are superfluous, . . . or, as he says: The text is correct, but Aristotle simply has not brought the second view, which is parallel to that of Democritus—namely, that the basic components are not all made up of the same kind of matter, which is the view of the school of Anaxagoras.

Now it is absurd to expunge a reading on which all manuscripts agree, and no less absurd to claim that Aristotle's outline is incomplete either in its phrasing or in the parallelism between its sections. But it is especially absurd to hold that the theory of Anaxagoras, against whom Aristotle so often argues, is entirely omitted. It is also inadmissible to do as other commentators do and to expunge Aristotle's reference to contrasting properties in Democritus' theory, in an attempt to achieve a symmetric outline of the various theories concerning the basic constituents of the universe. For it is certainly possible that the reference to difference in shape, i.e. to difference in structure which is linked to shape, was made with Democritus in mind, since he holds that the atoms are absolutely identical in the substance of which they are made. The reference to an infinite number of basic components, which are not made up merely of *different* kinds of matter but even of matter having *contrasting properties* could then easily have been made with the positions of both Democritus *and* Anaxagoras in mind. Accordingly Aristotle would be saying: either, as Democritus would have it, all of one kind but of different shapes or properties; or else not only different in shape and in the properties which are linked to shape, but even contrasting. This would imply that Democritus held that the basic components contrast with one another in shape and in orientation, while Anaxagoras held that they contrast with one another in their substance and in the kind of matter they contain.

If such an interpretation of this text is acceptable, it would not be necessary either to amend the text, or to attack the outline for lack of symmetry, or to expunge Aristotle's reference to contrasting properties in Democritus' theory.

623

Ibid. 153.26 (*On* 187a21)[1]

After having discussed those he considers physicists among the group which holds that there is one underlying kind of matter in the universe, . . . Aristotle proceeds to discuss Empedocles and Anaxagoras and their schools, the ones who hold that the basic components of the universe are a single one on the one hand, and a plurality of things on the other hand. Anaxagoras held that the homoeomeries are the basic components which make up the substratum, and that they are infinite in number; and, in addition, that there is one factor responsible for fashioning things—namely, Mind, which forms things into distinct entities . . .

Perhaps however it is wrong to say that 'a single one'[2] means for them the factor which fashions all things. Perhaps we should say instead that it refers to the mixture which according to Anaxagoras was made up of numerically infinite homoeomeries . . .

Theophrastus associates Anaxagoras with Anaximander and says it is possible to interpret Anaxagoras' words as implying that he meant that there is a single underlying kind of matter. In his *Physical Theories*[3] he writes: If we assume these things, it might seem that he holds that the basic building blocks of matter are infinite in number, as we have said, and that there is only one source of motion and of change. If however one assumes that the universal mixture is a single entity, of indeterminate properties and size, as Anaxagoras seems to imply, it turns out that he means that there are two basic entities in the theory, namely, the infinite substance and Mind. Accordingly Anaxagoras seems to follow very closely Anaximander's treatment of the basic building blocks of matter.

It was logical of Aristotle to place those who hold the basic components of the universe to be both a single one and a plurality of things after those who hold that there is only one basic component, either static or dynamic, and before those like the school of Democritus, who seem to say only that there is a plurality of basic components; for their position is truly intermediate. They resemble those who hold that there is only one component and that physical change arises from processes of dissociation and recombination.[4] Anaxagoras however seems closer to those who hold that there is only one component and who say that physical change is a result of processes of extraction. But the intermediate group differs from those who say there is only one component in that its members say that the basic components of the universe are both a single one and a plurality of things. Furthermore they differ among themselves. Anaxagoras said that the world was formed only once out of the mixture, and that ever since then Mind, which is supreme over it, governs it and fashions distinct objects in it. Empedocles, on the other hand, assumed that alternately at given intervals the four basic kinds of matter coalesce through the agency of Affinity and then separate and become distinct through the agency of Repulsion. They also differ in that Anaxagoras assumed the plurality of things making up the universe to be the homoeomeries, which are infinite in number; while Empedocles held this plurality to be finite in number, being the four so-called elementary kinds of matter. The first calls the plurality of things 'homoeomeries', the second calls it 'elementary kinds of matter.'

Alexander says: Aristotle added the words "along with contrasting qualities"[5] when referring to Anaxagoras' theory, because contrasting qualities as well as *all* properties are present in the homoeomeries. Accordingly, he says, the phrase "or even of matter having contrasting properties"[6] should be understood to apply more to Anaxagoras than to anyone else.

Perhaps however there are also contrasting properties, such as heat and cold, dryness and wetness, heaviness and lightness, and so forth in the four elementary kinds of matter of Empedocles; and perhaps the words "along with contrasting qualities" thus apply to both theories. On the other hand if some of these contrasting qualities are missing in Empedocles' four elementary kinds of matter, while absolutely all of them are present—together with *all* properties—in the homoeomeries, then there would be reason to believe that the words "along with contrasting qualities"—especially in view of the presence of the article[7]—are more suitably applied to the opinion of Anaxagoras alone. On the other hand it may be that all of these contrasting properties *are* in fact possessed by Empedocles' four elementary kinds of matter—since these four elementary kinds of matter are basic building blocks of everything else—but that they are not *all* inherent in them as primary qualities, as they are in the case of the homoeomeries; for perhaps sweetness and bitterness, in the theory of the four elementary kinds of matter, are not primary qualities inherent in matter, but result rather from heat and cold, and dryness and wetness. In the homoeomery theory however all of them are independent, primary attributes, like the two contrasting colors.[8] Or maybe even in the homoeomery theory some of the contrasting qualities are primary and others are secondary; at any rate, Anaxagoras says in the first book of the Physics: For water precipitates out of the clouds and earth out of water. Stone congeals out of earth because of cold. These precipitate more out of water.[9]

Anaxagoras clearly indicates that he thinks an infinite number of homoeomeries precipitate out of a single universal mixture of all things, and that each of them is characterized by the component which predominates in it. Thus he says in the first book of the *Physics* at the very beginning: All things in the universe were together, infinitely many and infinitely small. For the small was infinite. Nothing could be discerned in the universal mixture because the pieces were minute. For infinite air and aether surrounded everything, since they were the most numerous and bulky constituents in the universe. A little further on he says: And indeed air and aether separate out of the immense surrounding medium, for the surrounding medium is infinite, numerically. A little further on he says: Therefore one must conceive that many different kinds of things, particles of all substances, possessing all features, colors, and tastes, are present in the universal mixture. Before different things were separated out of the universal mixture, he says, no color could be discerned in it; for the blending of all things—wetness and dryness, heat and cold, brightness and darkness, together with a great amount of earth and an infinite multitude of completely dissimilar particles—made discrimination impossible. For no two of the other things[10] are similar to one another.

Anaxagoras clearly indicates that the homoeomeries do not undergo physical change, but remain always the same. Thus he says: It must be made clear that even after matter was formed into distinct entities in the way we have described, the sum of all things in the universe neither increased nor diminished. There can never be more than the totality of all things, but the sum of all things in the universe always remains the same.

So much for the mixture and the homoeomeries. He writes the following about Mind: Mind is unbounded and autonomous, compounded with nothing material. It alone is free from everything else. Indeed if it were not free from everything else, but were compounded with any one thing, it would have to contain something of all things, being compounded with one; for all things contain something of everything, as I have said before. Then the things compounded with it, if it were compounded, would prevent it from having mastery over everything, as only an entity free from everything can have. Indeed it is the most insubstantial of all things, and the most pure. It comprehends all things, and its power is greatest. Mind has mastery over all things, great and small, in so far as they have life. And Mind managed the entire churning motion, bringing about a churning motion in the beginning. First a little churning began. Afterwards, the churning became greater, and it will churn even more. And Mind knows and perceives all things, those in the mixture, those separated out, and those formed into distinct entities. And Mind set in order all the kinds of things which were going to exist: those which have existed, as many as now exist, and those which will exist; and the rotational motion participated in at the present time by the heavenly bodies, the sun, the moon, and the air and the aether, which are being separated out.[11] This churning makes the separation occur. Dense is separated from rare, hot from cold, light colors from dark, dry from wet. There are many pieces of many substances, but nothing at all is ever separated or distinct from other things except Mind. All parts of Mind, both large and small, are exactly identical. Nothing else however is exactly identical to anything else; but rather the predominant component of any particular object always comes to view and determines what the object is.

It is clear from what has been said that Anaxagoras thought there were two orderings, one mental, and the other, patterned on the first, among perceptible objects. This is also clear from the following: Mind . . . all the things that exist in the full sense as well as now in the place where all other things exist, i.e. in the medium which surrounds many things and in the midst of things which have been assembled and things which have been taken apart.[12] And indeed he says: that many different kind of things, particles of all substances, possessing all features, colors, and tastes are present. And men and all other animals—those things which have life—were formed. And he adds: And these men had towns joined together, and suitable employment, just as we have. And they had among them sun, moon, and other heavenly bodies, just as we have. The earth brought forth for them a wide variety of produce, the finest of which they gathered into their homes and put to use. The repetition of the phrase "just as we have" clearly indicates that Anaxagoras is alluding to another ordered realm besides the one we know. And the phrase "the finest of which they gathered into their homes and put to use" clearly indicates that he does not consider this other realm to be an ordering of perceptible objects or to be earlier in time than the present one; for he did not say "put to use" in the past tense, but "put to use" in the present tense. Furthermore he does not believe that their setup differs from our present one only in place, but is in other respects similar; for he did not say, "And there was among them also *the* sun and *the* moon, just as we have," with the definite article, but instead he said, "Sun and moon, just as we have," without the definite article, referring to another sun and moon. However it is worth investigating whether or not this is so.

624

Ibid. 161.23 (*On* 187a26)[1]

Here too Aristotle tries to be as fair-minded as Plato, for he wishes to combat the impression that the theories of famous ancient men are completely absurd; nor does he wish to dismiss them out of hand and condemn them without a hearing. Instead he presents the arguments which led them to their seemingly incongruous opinions. He treats Anaxagoras first because he intends to scrutinize those thinkers who hold the basic components of the universe to be infinite in number directly after those who say that only one thing really exists . . .

Aristotle says then that two things lured Anaxagoras into believing in the theory of homoeomeries. The first is "because he accepted the common opinion of physicists," which is "that something cannot come out of nothing," so that anything which comes to be must arise from something which exists. . . . Anaxagoras, then, held that it is an axiom that something can not come out of nothing, and he seems to have set up an argument which runs something like this: Something comes either out of something which exists, or out of nothing. But it is impossible for something to come out of nothing. Therefore, it must come out of something which exists, and it must have been present earlier in that from which it arose. Indeed it does not appear that anything is added from the outside when wasps arise from horseflesh, or when vapor is formed out of liquid. Therefore in any homoeomerous body there must exist flesh, bone, blood, gold, lead, sweetness, and whiteness, since all things are in all things; these things being imperceptible, however, because they are so small. For how could it appear that everything arises from everything else, albeit through a number of intermediate steps, if all things were not in all things? An object, then, seems to be what it is, and receives its name, according to its predominant component. For a material object, it seems, can not be purely white, black, sweet, flesh, or bone, but rather appears to be the component which predominates in it, since all things are always in everything. For Anaxagoras says: Nothing ever undergoes physical change, but things are formed from existing things by coalescence and dissociation. For the same reason, at the very beginning of his book he says: All things in the universe were together.

Alexander says that the phrase "all physical change is qualitative change plain and simple" is aimed against Anaxagoras, because in his book *On Physical Change*[2] Aristotle attacks Anaxagoras for having said that dissociation and recombination, by which things undergo physical changes, are the same as qualitative change. There, Aristotle says, "Anaxagoras, however, did not understand the implications of his own words." At any rate, Aristotle says that "all creation"[3] and destruction "is qualitative change plain and simple"; meaning, according to Alexander, that Anaxagoras used the wrong term when he called dissociation and recombination 'qualitative change'.

Porphyry however says that the words "all things always coexisted" refer to Anaxagoras; that the statement that physical change is qualitative change refers to Anaximenes; and that the statement about dissociation and recombination refers to Democritus and Empedocles. However Anaxagoras writes clearly in the first book of the *Physics* that physical change is dissociation and recombination in the following words: The language the Greeks use to describe physical change is incorrect since nothing ever undergoes physical change, but things are formed from existing things by combination and dissociation. Accordingly the correct usage would be to call coming into existence 'combination', and to call destruction 'dissociation'.

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Ibid. 163.9 (*On* 187a31)[1]

"And also because of the fact that an object passes from one state into its opposite, from which he concluded that the second state must have existed in the first." This is the second thing, Aristotle says, which led Anaxagoras to assume that the homoeomeries are the basic building blocks of all things. In nature contrasting qualities cancel one another out and certainly do not promote each other's existence. On the other hand contrasting qualities do seem to change into one another. The only thing one can expect to find therefore is that things with contrasting qualities exist in one another and become separated from one another, for this is the only way contrasting qualities could change into one another.

Now it seems absurd to say that things with contrasting qualities exist in one another. Yet things with contrasting qualities are found together all over, not only contiguous to one another, but even blended with one another; and to say that a thing gives rise to something completely unlike it is obviously absurd, for a thing can only give rise to something like it. Aristotle gives this as the second reason Anaxagoras was led to his theory of physical change. Together with the first reason given, this provides the basis for Aristotle's derivation of what immediately follows, namely, the logical proof of the statement that things which appear to come to be are in fact simply separated out from where they were present earlier; the initial assumptions being that something cannot come to be out of nothing, and that contrasting states change into one another.

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Ibid. 164.10 (*On* 187b7)[1]

Aristotle has first presented the persuasive features of Anaxagoras' theory, to avoid giving the impression that the theory will be easily proved wrong because of a weak defense. Now he turns to its refutation. Indeed Anaxagoras put forth many logical hypotheses and deductions, and it seems to me that Aristotle is now arguing against almost every one of them.

Anaxagoras says at the very beginning of his book that there are an infinite number of things: All things in the universe were together, infinitely many and infinitely small. He says that among the basic building blocks of all things there is no smallest or largest one: There is no smallest small object, but there is always something smaller than any given small object; for it is impossible for something which exists not to exist. On the other hand, there is always something larger than any given large object, and the components of the larger object are equal in number to the components of any given small object, so that inherently every object is both large and small. Indeed if everything is in everything, and everything can be extracted from everything, then one can always extract something smaller from an object which appears to be the smallest, and an object which appears to be the largest will always have been extracted from something larger. Anaxagoras clearly says that: All things contain something of everything, except Mind, and there are certain things which also contain Mind. He also says that: Other things contain something of everything, but Mind is an unbounded, autonomous entity, compounded with nothing material. Elsewhere he says the following: A large and a small object have an equal number of component parts. This gives further support to the statement that each thing contains all things. It is not possible for anything to exist apart, but all things contain something of everything. There can not be a smallest object. Therefore, nothing can be isolated or made free from everything else. Rather, all things coexist together now, just as in the beginning. All objects contain more than one substance, and there is the same number in large and in small objects which have been formed into distinct entities.

Anaxagoras also claims that each perceptible homoeomerous body is formed and characterized by the synthesis of exactly identical components, in what follows. He says: But the predominant component of any particular object always comes to view and determines what the object is. It seems that Anaxagoras also says that Mind attempts to separate the components, but can not. These hypotheses of Anaxagoras then are surely the sort of things Aristotle is arguing against. The first attack he makes is on the position that the basic building blocks of the universe are infinite in number.

As Porphyry says, this attack could apply to Leucippus, Democritus, and Metrodorus, as well as to all the others who say that the elementary kinds of matter are infinite. Now there are two kinds of infinity: infinite measure and infinite qualitative variation; and infinite measure can be either infinite number or infinite magnitude. All the natural philosophers mentioned above hold that the elementary kinds of matter are infinite in number, while Democritus and Leucippus and their school say also that empty space is infinite in extent. Anaxagoras however seems to say that the homoeomeries are infinitely varied in their properties, since he says: No one thing is exactly identical to any other of the infinitely numerous things. Therefore since everything infinite, in so far as it is infinite, can not be comprehended, and since something which can not be comprehended can not be known, it must be impossible to know the basic building blocks, and the elementary kinds of matter which compose all things. Thus it would also be impossible to know objects built up from the basic building blocks, since we think we know any particular thing when we know the factors responsible for it and the fundamental entities which go to make it up. It turns out then that all these people, who use these assumptions to attain knowledge of existing things, attain in fact the opposite—ignorance.

Aristotle's succinct refutation essentially amounts to the following: The homoeomeries are infinite both in kind and in number. Anything infinite in so far as it is infinite can not be known. Therefore the homoeomeries can not be known. Add to this that the homoeomeries are the building blocks of everything that exists, and the conclusion follows that everything that exists is made of building blocks that can not be known. Add to this, now, that things whose building blocks can not be known themselves can not be known, and the conclusion follows that everything that exists can not be known inasmuch as the building blocks of everything that exists are infinite in number. The inference that things whose building blocks can not be known can not themselves be known comes in the words: "since we say we know a composite object when we know the number and nature of its components."

Anaxagoras clearly indicates that he believed that there exists an infinite number of kinds of building blocks, infinite in the sense that they are incomprehensible to us, but not inherently infinite, in the following words: And Mind knows and perceives all things: those in the mixture, those separated out, and those formed into distinct entities. And Mind set in order all the kinds of things which were going to exist: those which existed, and as many as now exist and will exist. Thus, since they are known to Mind, they can not be inherently infinite; except that what Aristotle says is true: that if the kinds of basic building blocks can not be comprehended, neither can anything composed of them be comprehended.

It must be realized, as I have said, that Porphyry thinks this attack is made against all who assume that the elementary types of matter are infinite. Alexander however thinks it is directed against Anaxagoras alone, and perhaps his position is more reasonable. Indeed though Democritus and Leucippus and their school postulated the existence of an infinite number of basic building blocks, they assumed that these building blocks have a certain definite set of primary characteristic properties. Thus in their theory it would not be impossible to comprehend the building blocks, unless perhaps they endowed them with an infinite number of shapes or other such properties. Anaxagoras however assumed that the basic building blocks are infinite not only in number but also in variety. He then must bear the onus of apparently being the first to have formulated a theory which yields the absurdity that anything composed of the building blocks can also not be known.

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Ibid. 166.13 (*On* 187b13)[1]

Anaxagoras says that there is no smallest small object, but there is always something smaller than any given small object; nor is there any largest, as Anaxagoras' own words show. Thus too Theophrastus writes in his second chapter on Anaxagoras: Furthermore, it is not at all convincing to say, as he does, that all things can be in everything, because they are infinitely large and infinitely small, it being impossible to find either a smallest or a largest object.

Aristotle demolishes this position. First he proves a proposition which will be useful for almost all that follows: that there is a smallest piece (of flesh, for example). The proof is as follows: If the parts of an object can be of any size whatever—and this is just what it means to say that there is no limit to smallness and largeness—then the object itself can be of any size whatever. Now an object can not be of arbitrary size. Therefore its parts can not be of arbitrary size either, by inversion. Aristotle has introduced his basic premise as a self-evident statement. For it is clear that if an object is composed of certain parts like feet, hands, and head, and if these parts can be of arbitrary size, then the object (which is what it is by virtue of these parts being put together) will be larger when they are larger, smaller when they are smaller, and so forth without limit, the variation in size always corresponding to the largeness and smallness of the parts. The second premise also consists of clear and evident statements. For entities, like an animal or a plant, synthesized and composed of homoeomeries, can not be of arbitrary size, since a man can not be the size of a grain of millet, or a fig the size of a mountain, but their size is bounded in both directions. Accordingly the size of each of the parts of which they are composed is also bounded, so that one can not have a piece of flesh of arbitrary size, since flesh is part of an animal; for in that event the animal of which it would be a part could also be of arbitrary size. Now according to Anaxagoras animals are made up of such homoeomeries and decompose into them; for there is nothing more elementary, according to him, into which they might decompose. Therefore the size of the homoeomeries too must be limited to a range in which they preserve their characteristic properties.

Should someone reply that any extended object can be indefinitely subdivided, and that therefore there is always something smaller than any given object, he would simply be displaying his ignorance. Homoeomeries are not simply extended objects, but extended objects like flesh, bone, lead, gold, and such, which can not be subdivided indefinitely and still retain their properties. In so far as they are extended bodies these homoeomeries can indeed be subdivided indefinitely, but not in so far as they are flesh and bone. Anaxagoras assumed that the building blocks were like these; and hence they can not be indefinitely subdivisible.

Now the parts of an object are those distinct parts, like homoeomeries, into which the object can actually be subdivided, and not just extended pieces of matter. Certainly this is the reason Aristotle added "where I mean by 'component parts' actual subdivisions of the whole into which it can be broken up." Indeed an object is not broken up into arbitrary pieces of extended matter, but into pieces of flesh and bone as such. According to Anaxagoras, these parts can never be destroyed and thus can not be broken up to such an extent that their characteristic properties are destroyed. Again, the parts which result from a process of infinite subdivision are never subdivisions actually present in the whole; rather, they are present only potentially. These are the reasons Aristotle added the above parenthetical remark. An object can not be subdivided into just anything which goes to make it up; for example, matter and properties go to make up an object.

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Ibid. 168.14 (*On* 187b13)[1]

Alexander says: The word 'particle'[2] is added[3] since, according to Anaxagoras, there are certain kinds of homoeomeries which cause plants to grow when their number increases. Furthermore, the differences between plants derive from the differences between the particles which increase in number in them.

However the seed[4] out of which a plant grows is not one of the "actual subdivisions of the whole into which it can be broken up," for in animals too the seed from which they grew is not preserved in them in a way that one could cut the animal up and find it there.

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Ibid. 168.25 (*On* 187b13)[1]

The following defense of Anaxagoras' position could be made: The differences in size among plants and animals would depend upon variations in size of homoeomeries only if each individual animal or plant contained but one homoeomery of each type of homoeomerous substance in its composition. However if each individual animal or plant contained a number of homoeomeries of each kind, as for example more than one piece of flesh, why could not the animal be finite in size even though the pieces of flesh were infinitesimal?

However if there are more than one piece of flesh, then there must be either a finite or an infinite number. If there is a finite number, like three, four, or ten thousand, then there must be a definite lower and upper bound to their size. If however there is an infinite number, any object composed of an infinite number of extended bodies would have to be infinite in size. Indeed any finite object contains subdivisions of finite size, as Aristotle himself adds here.

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Ibid. 169.3 (*On* 187b22)[1]

Alexander says that here Aristotle employs the earlier argument to demonstrate that it is not true that physical change involves the reassembling of component parts, or that all things are in all things, both views held by Anaxagoras and his school.

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Ibid. 171.4 (*On* 187b22)[1]

It is clear, as I have remarked above, that the process of extraction spoken of here should not be understood as a theoretical subdivision into an infinite number of parts. If it were it would not have to terminate, nor would it be logically impossible for a finite body to be composed of infinite subdivisions, since finite bodies are always potentially subdivided into an infinite number of parts, though they are not actually so. The process of extraction Anaxagoras talks about however involves the extraction of an infinite number of actually existing bodies.

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Ibid. 171.29 (*On* 188a2)[1]

The most cogent refutation of Anaxagoras' theory is found here in the fifth argument, I think, at least if it is taken in its simple meaning. The present argument is directed against the entire theory that the building blocks of all things are infinitely numerous homoeomeries, and that all things are mixed in all things, a theory stated by Anaxagoras at the beginning of his book, where he says: All things in the universe were together, infinitely many and infinitely small. For the small was infinite. He also often says: All things contain something of everything, except Mind. If then there are an infinite number of homoeomeries, and all things exist in each one, there must actually exist in each homoeomery an infinite number of pieces of flesh, of blood, and of brain. And since there would be an infinite number of pieces of flesh in each one of the infinite number of homoeomeries, the entire amount of flesh would be infinite in size, and the same would hold of course for blood, brain, gold, and everything else. There would then exist more than one infinitely large body and indeed an infinite number of such bodies, one for each type of homoeomerous matter. This is patently absurd, since an infinitely extended body is, by definition, something outside of which there is no other extended body.

Furthermore the infinity talked about here is not the potential infinity which comes up in the case of things which undergo continuous change or are infinitely subdivisible; rather, what is meant here is an actual infinity, as we see from the phrase which Aristotle slips in: "real and distinct entities"—as real as the objects which they compose.

Again, it is even more absurd to hold that distinct entities are infinite, since entities which are distinct from one another bound one another. Aristotle says that these infinites are distinct, not only because flesh, bone, and each of the other homoeomeries comprise an infinite number of distinct homoeomeries, but also because Anaxagoras himself says: Nothing is exactly identical to anything else; so that, by their very nature, they are distinct from one another. . . .

Alexander says: Perhaps however this is not the way to interpret the argument. Maybe Anaxagoras was not referring to the basic building blocks when he said that all things are compounded of all things. Perhaps he did not mean that all things are in each basic building block, since in that case they would no longer be basic building blocks, but compounds. He might have meant instead that every *perceptible* body compounded of the building blocks is a compound of all things. For physical change, i.e. dissociation and recombination, must involve compounds, since pure substances are basically imperceptible,[2] and indeed can not even exist apart, because they can not be completely separated from one another.

However all Alexander does with this interpretation is to shift the argument to compounds, where the refutation still holds . . .

Perhaps Anaxagoras' theory would appear more plausible if it were not taken to mean that any arbitrary kind of matter can be extracted from a particular perceptible body in quantities large enough to be perceived—e.g. not that a perceptible quantity of bone can be extracted from a single given piece of flesh, or that a perceptible quantity of something else can in turn be extracted from the bone—but were taken instead to mean that all things are in each perceptible thing, but that they are there in imperceptible amounts. Then indeed all things could be extracted from each perceptible body, but they would remain imperceptible until many pieces of matter with the same properties, extracted from many different perceptible bodies, coalesced and became perceptible. All things then would again be in each of the newly formed composite bodies, and the appearance of each of these composite bodies would be determined by the predominant component in it.

But even though I have said all this, it can not be right. First, it can not be true—as *they* say—that any arbitrary kind of matter comes to be out of each perceptible body in quantities large enough to be perceptible, for in that case, as we saw above, infinitely many infinities would follow. Second, it can not be as *I* say, for if the basic kinds of matter were really infinite in number—i.e. if indeed an infinite number of homoeomeries really existed in a finite perceptible body—similar absurdities would follow. However when Anaxagoras said that the basic kinds of matter are infinite, he could not have meant that they are by their very nature infinite in number, i.e. not denumerable; rather he must have meant that they can not be grasped by us, though inherently they are finite and determinate in their properties and in their number. For he says: And Mind knows and perceives all things: those in the mixture, those formed into distinct entities, and those separated out. And Mind set in order all the kinds of things which were going to exist: those which existed, as many as now exist, and those which will exist. Now if the basic kinds of matter and things compounded of them were in fact numerically infinite, Mind could not have known and perceived them, nor could it have set them in order; for setting things in order is putting them in order one by one, and this can not be done with an infinite number of things. Moreover, the act by which Mind perceives and knows something has a beginning and an end and is not an interminable act, and what Mind perceives are properties which have a limited range, not an infinite range. Anaxagoras makes it clear that he does not mean infinite in the sense of completely inexhaustible number, for he calls even Mind infinite when he says: Mind is unbounded[3] and autonomous. Furthermore, if it is true that Anaxagoras did not say that there are an infinite number of basic kinds of matter, then the compounds made up of these would not be infinite, but finite in kind, and each of them would be composed of a finite number of homoeomeries.

Nor does it seem that Anaxagoras held that all things could be extracted from all things, even though he said that all things in the universe are together. For he clearly meant to say that only objects possessing contrasting qualities are separated one from another, and not just anything from anything else. Thus he says: This churning makes the separation occur. Dense is separated from rare, hot from cold, light colors from dark, dry from wet. Thus, not just anything is separated from anything else—e.g. flesh is not separated from water, or brain from water.

In this way Anaxagoras will elude all the charges brought against him: If the basic building blocks are not infinite in number, then they are not beyond comprehension; the things compounded of them are not beyond comprehension; nothing infinitely small or infinitely large will be able to exist; and a process of extraction will not be able to continue indefinitely as it would if there were infinite kinds of matter in any body. If however Anaxagoras meant to say that the building blocks are finite in number, other arguments must be brought against him based on the fact that, for him, coming to be is dissociation and recombination: How can a spoonful of vapor be extracted from a spoonful of water, unless the water undergoes qualitative change? What is the factor which fashions man out of flesh and bones where man did not exist previously? Since we see that a man is formed out of components which are not themselves man, what is there to prevent flesh from being formed out of that which is not flesh by the same factor which forms man—whether this factor be Mind, or any other factor? In general, since they do not go so far as to say that non-homoeomerous bodies, such as animals and plants, are formed by processes of extraction, why must homoeomerous bodies be formed in this way? Why are the homoeomeries not subject to physical change while the things compounded of them are? Certainly the whole is more perfect than the parts!

Note that Aristotle classes the brain as a homoeomerous body, although it is an organ of the body, having veins and arteries throughout its extent, and being divided by membranes.

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Ibid. 175.9 (*On* 188a5)[1]

Anaxagoras says: One thing is never distinct or separate from other things, because all things are in all things. Elsewhere he says: Nor is hot hewn apart from cold, nor cold from hot, for there is nothing which is pure and exists apart. Aristotle says that this is said without real comprehension, for things happen not be to distinct from one another, but not because all things are in all things; still things do not in fact happen to be distinct from one another. Therefore, though the statement was made without real comprehension, it is still true. . . . Now the subdivision of an extended body is a process which must stop at the smallest possible subdivision, and what is meant by a quality being separated off is the separation of properties from objects. The first process is impossible, according to Anaxagoras' view, because there is no smallest subdivision of matter; for if there were a smallest particle everything would not be in everything. The second process is impossible, according to Aristotle's view, since he holds that qualities are inseparable from objects. Therefore Mind is ridiculous, either because it does not know what can not be done, or because, knowing what can not be done, it still attempts to

Anaxagoras did not say straight out, as far as I know, that Mind's

do it. So much for the elucidation of Aristotle's argument.

aim is to separate the homoeomeries, but the task it sets itself can not be accomplished. He said rather that Mind is the origin of motion and change, gives things rotational motion, sets things in order, and is responsible for all processes of extraction. Thus he says that Mind originated the churning and adds: This churning makes the separation occur. Dense is separated from rare, hot from cold, light colors from dark, dry from wet. And a little farther on he says: One thing is never distinct or separate from other things. From this we see clearly that in one place he says: Dense is separated from rare, etc., and in another place: One thing is never separate from other things. Thus in one place he speaks as if it is *not* true that all things come from one another—for he did not say that a line is separated from white, but only that entities possessing contrasting qualities come to be from one another; but he also says that there is no gap between things in the ordered universe: They are not hewn apart from one another, as he says elsewhere as well—instead, they coexist with one another and are found in one another like things blended into one.

Therefore all the different kinds of things are both separated *and* blended together according to Anaxagoras, and both states exist through the agency of Mind. Thus Anaxagoras gave Mind its due when he extolled it, saying: Mind is unbounded and autonomous, compounded with nothing material. It alone is free from everything else. And again: Indeed it is the most insubstantial of all things, and the most pure. It comprehends all things, and its power is greatest. Mind has mastery over all things, the great and the small, in so far as they have life. And Mind managed the entire churning motion. And Mind knows and perceives all things: those in the mixture, those formed into distinct entities, and those separated out. And Mind set in order all the kinds of things which were going to exist; those which existed, which do not now exist, and those which will exist.

Thus according to Anaxagoras Mind's aims are not impossible to attain. Rather, Mind, being completely set apart from all kinds of things in the world, does distinguish them by means of *mental* distinctions; all the different kinds of things in the perceptible world, however, are actually blended with one another, because the characteristics which distinguish them from one another are basically mental, and because they come to be in a state of confusion.

As for Socrates' complaint against Anaxagoras in the *Phaedo*[2] that he does not use his Mind when he gives explanations for detailed phenomena, but uses instead explanations based on the way matter behaves—this objection was applicable to all natural philosophy. Thus even though, in the *Timaeus*, Plato describes a factor which is responsible in general for fashioning things, he too uses size and shape in his explanations of detailed phenomena such as heat and cold and other such things. Socrates however wished to stress teleological explanations, and therefore brought up Anaxagoras as an example of a person who used explanations based on the behavior of matter instead of teleological explanations.

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Ibid. 177.18 (*On* 188a13)[1]

Anaxagoras says that physical change is the result of dissociation and recombination, and that the appearance of each thing is determined by its predominant component, all things being in each thing. What he means by this is clearly that every composite body is formed by the synthesis of component parts similar to the whole. He said this because he saw that composite bodies divide into parts similar to themselves: flesh into pieces of flesh, bone into pieces of bone; and also because component parts are understood to be that into which a body can be divided.

However, it is not at all necessary for something to be formed of components having properties identical to its own. This is especially true when we consider the *basic* building blocks of which a body is composed. On the contrary, things are surely not formed in this way. True, a body may be formed out of parts whose properties are identical to its own, as a large piece of mud is formed from many smaller pieces of mud. But if we consider the *basic* building blocks out of which a body is composed, then we must say that a body is formed out of parts which are dissimilar to the whole and simpler in their nature, and that it can be decomposed into them, just as a brick is made up of earth, water, and straw, and can be decomposed into them.[2] The more basic the components into which you analyze something, the more dissimilar these are to the whole. Indeed there are component parts of flesh which are similar to the whole—to wit, pieces of flesh—but there are also components which are closer to the basic kinds of matter. These are no longer flesh but, for example, blood, and, if you go still further, the four elementary kinds of matter with their distinguishing properties. We must conclude then that things are not formed simply when their parts are assembled, in the way that a house is made out of bricks, nor can things be subdivided into elementary component parts in the way that a house can be broken up into bricks. It works differently. Water and vapor come to be from one another when their properties change, not when their parts coalesce or are extracted from one another. Otherwise, could a spoonful of vapor come from a spoonful of water?

Thus we see that physical change is not the result of dissociation and recombination, as Anaxagoras seems to hold, but is the result of transformation—that is, of change of properties—as Aristotle and others hold.

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Ibid. 178.12 (*On* 188a17)[1]

Empedocles and Anaxagoras account for physical change in the same way in so far as both explain it as a process of dissociation and recombination. They differ however in the number of elementary kinds of matter involved, and "it is better to assume the existence of a smaller—finite—number of elementary kinds of matter, as Empedocles" did, than to assume the existence of a larger, indeed infinite, number as did Anaxagoras. It is better to have finite quantities than infinite ones since a finite quantity can be perceived and known, while infinite quantities can neither be perceived nor known. Especially in a case where the same results can be reached with a smaller number of elementary kinds of matter, what need is there for a larger, infinite number? There is no need, since when physical change occurs certain things appear and others disappear, and the disappearance of the things which previously existed suffices to account for the appearance of others.

Now all those like Democritus who assume the existence of an infinite number of worlds are forced to say that there are an infinite number of elementary components of matter; but even they are not forced to say that these are infinitely varied in their properties. On the other hand those like Anaxagoras and Empedocles who hold that there is only one world have no need to resort to infinities. Therefore Empedocles does better to say that there are a finite number of elementary kinds of matter because he thus avoids all the problems mentioned above as attendant upon the assumption of infinities.

I have attempted above however to establish that Anaxagoras did not mean that the elementary kinds of matter are infinite in the sense of being unbounded in number. However, even though Anaxagoras too says that there are only a finite number of different kinds of matter, Empedocles penetrated to a more fundamental level when he assumed the existence of simpler elementary components of physical objects—to wit, colorless gas, clear liquid, dry dust, and heat substance—rather than assuming that the basic components of objects are identical in nature to the objects made up out of them.

Perhaps however Anaxagoras assumed not that composite bodies but that qualities, which are simple and more fundamental, are the elementary components of matter.[2] Thus he says: This churning makes the separation occur. Dense is separated from rare, hot from cold, light colors from dark, dry from wet. And a little later: Dense, wet, cold, and murky things congregated where the earth is now, and rare, hot, and dry things dispersed to the outermost parts of the aether. He says then that these more fundamental, simplest kinds of things are separated out, and that other things—as he says elsewhere—which are more composite than these are either congealed the way compounds are formed, or precipitated out the way earth is. Thus he says: Earth is congealed from these things[3] when they are precipitated out. For water precipitates out of the clouds and earth out of water. Stone congeals out of earth because of cold. It seems then that Anaxagoras, in having recourse in this way to simple properties, is constructing a theory about the elementary kinds of matter which is closer to fundamentals than Empedocles'.

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Ibid. 180.25 (*On* 188a19)

Aristotle leaves out Empedocles and Anaxagoras here: Empedocles, because it is quite clear that according to him contrasting qualities are inherent in the elementary kinds of matter and arise from the action of Repulsion and Affinity and, yet again, arise from processes of dissociation and recombination—for he says that physical change is nothing but "simply mixture and separation of mixed things"; Anaxagoras, because, as Aristotle mentioned earlier, he held that pairs of contrasting qualities are in the basic building blocks. There Aristotle explained the difference between Anaxagoras and Empedocles as follows: They differ from one another in that one says that this process occurs periodically, while the other says it happened only once. In addition, one posits the existence of an infinite number of molecules and qualities, while the other posits no more than his so-called elementary constituents of matter.

Anaxagoras in his own words explains clearly that contrasting qualities are involved in the formation of things, saying: This churning makes the separation occur. Dense is separated from rare, hot from cold, light colors from dark, dry from wet.

637

Ibid. 235.18 (*On* 191a23)

Of those who denied the existence of physical change, . . . some, like Anaximander and Anaxagoras, held that there are many things which actually exist, and that these things are found in one another and are extracted from one another—so that there is really no such thing as physical change; and still others, like Democritus and Empedocles, held that physical change results from the dissociation and recombination of the basic elementary kinds of matter.

638

Ibid. 300.27 (*On* 194a15)

Alexander says that Aristotle does not bring up Anaxagoras here, because even though Anaxagoras includes Mind among the basic concepts of his theory he makes no use of Mind in accounting for physical change. However it is quite clear that Anaxagoras does make use of Mind, since he says that physical change is just a process of extraction, that processes of extraction are the result of motion, and that motion in turn is caused by Mind. Anaxagoras says: And when Mind began to cause motion, things began to be separated out of the entire mass which was being moved. The more motion Mind introduced, the more this entire mass was divided into distinct entities. And the churning of the things being moved and separated from one another caused them to be separated even more.

The reason Aristotle does not bring up Anaxagoras here is that Anaxagoras did not say that Mind embodies the predicates applied to matter, and this happens to be the subject under discussion. What Anaxagoras says is that Mind is a factor responsible for forming distinct entities and setting them in order, and that it is separate from the things it sets in order and has a different kind of existence from theirs. Thus he says: Mind is unbounded and autonomous, compounded with nothing material. It alone is free from everything else. And he goes on to tell why this is.

Perhaps however the reason Aristotle does not bring up Anaxagoras here is that, as it seems, his Mind does not create the predicates which distinguish things, but only separates them from one another. But in fact the process of forming distinct entities out of the state in which all things were blended into one—in which "all things in the universe were together"—is a mental process.[1]

639

Ibid. 327.26 (*On* 195b11)

Anaxagoras forgot Mind, as Eudemus said, and accounted for the formation of the many existing things with processes taking place all by themselves.

640

Ibid. 369.26 (*On* 198b10)[1]

Some people may introduce other factors to account for things, as Empedocles does with Affinity and Repulsion, which fashion things; and as Anaxagoras does with Mind; but when they bring them up they only touch on them and do not make use of them in giving an account of the factors which make things behave as they do. It seems that this is the same charge Socrates brings against Anaxagoras in the *Phaedo*.[2]

641

Ibid. 386.22 (*On* 199b34)

Since heat is light and rises, and cold is heavy and falls, the world was formed as it is, with earth below and heat substance above . . . This was the opinion of Anaxagoras. In their theories neither he nor Empedocles had yet reached the idea of a perfect final state toward which things tend, but they cited only the natural behavior of matter, thinking that this automatically leads to the most perfect final state.

642

Ibid. 453.1 (*On* 202b36)

The followers of Anaxagoras and of Democritus say that the basic building blocks of all things happen to be infinite in number; one group says this of the homoeomeries, the other says it of the atoms. However, all of them are also forced to speak of infinite extent.

643

Ibid. 458.26 (*On* 203a16)[1]

Other natural philosophers say there are an infinite number of elementary kinds of matter. Thus Anaxagoras and Democritus brought in not only infinity of number but also infinity of extent.

644

Ibid. 459.10 (*On* 203a16)[1]

If, as we said above, Aristotle considers only those who limit their discussions to the behavior of matter to be real physicists . . . he might not consider Anaxagoras to be one either, since Anaxagoras said that Mind forms the homoeomeries into distinct entities. Perhaps however Aristotle might apply the name to him since it seems that not even he uses his Mind to explain the way things come about, preferring explanations which have to do with the behavior of matter.

Aristotle says that all those who say there are an infinite number of elementary kinds of matter—like Anaxagoras, who introduces an infinite number of homoeomeries into his theory—. . . obviously introduce numerical infinity into their theories. Aristotle points this out in the words "Those who believe that there are an infinite number of basic constituents of matter"; and shows that these people also introduce infinity of extent, with the words "say that that which is infinite is composed of an infinite number of bodies in continuous contact with one another," i.e. is a continuum by virtue of having all of its parts in contact with one another, and not by virtue of being inherently one . . .

645

Ibid. 495.29 (*On* 203a23)[1]

Now some natural philosophers held that there is only one basic kind of matter; others that there are more than one, but a finite number; and still others that there are an infinite number. Aristotle has already told us that those who held that there is only one believed that it happened to be infinite in extent, while those who held that there are a finite number having finite extent believed that there is no infinity either in number or in extent. He now goes on to discuss those who say that there are an infinite number, and points out that they introduce infinity both in number and in extent. For an infinite number of actually existing magnitudes which are in continuous contact with one another must be infinitely extended, as we said earlier. Now Anaxagoras and Democritus posit an infinite number of basic building blocks of matter—Anaxagoras, the homoeomeries; Democritus, the atoms. Aristotle first investigates the theory of Anaxagoras, and explains what it was that led Anaxagoras to his ideas.

Aristotle also demonstrates that Anaxagoras must say not only that the entire mixture is infinite in extent, but also that each homoeomery is infinite in extent, inasmuch as it contains within it all things, as does the whole mixture. And they are not only infinite, but infinitely many times infinite. Anaxagoras arrived at this conception by postulating that something can not come out of nothing, and that something increases in size only by the addition of something similar to it. He then observed that all things come out of any particular object either directly or through a series of intermediate steps: Gases and vapors come out of fire, water out of gases and vapors, earth out of water, stone out of earth, and fire in turn out of stone. He observed too that when any particular food—for example, bread—is taken in, many dissimilar things are formed out of it, like flesh, bone, vein, muscle, hair, fingernails, and, as the case may be, feathers and horns. And he also observed that things increase in size by the addition of matter similar to the matter they are made of. From all this he concluded that the substances that are formed from food are in food, and that wood, bark, leaves, and fruit are in water, since plants are nourished by water. Therefore he held that each thing is compounded of all other things, and that physical change arises through dissociation and recombination. In addition, he may have taken into consideration the observation that certain things remain unchanged during the time that other substances are arising out of them—for example, when fire comes out of stone, and when gases and vapors come out of boiling water.[2] Furthermore, seeing that all things are extracted from each object which now exists as a distinct entity—for example, flesh, bone, and the rest from bread—as if all things exist together in it and are mixed together in it, he conceived the idea that all things in the universe were mixed together before being formed into distinct entities. For this reason he began his work with the words: All things in the universe were together.

Thus anything—for example, any piece of bread—is a mixture of flesh and bone just like the universe. Anaxagoras inferred that all things in the universe were mixed together from the fact that each thing is compounded out of all things, proceeding from the particular case to the general case, since the particular case is more easily observed. From this similarity between each thing and the universe he constructed a theory about the mixture and about the original act in which things were separated into distinct entities during a span of time, giving rise to all things. He held that just as the extraction of something from a given object has a definite temporal beginning, so too the extraction of objects from the universal mixture had a definite temporal beginning; and just as different things emerge from a given object each at a different time, so, since there was an initial act in which all things were formed, all the things that were formed in this initial act were not extracted from the universal mixture at one time. Again, since bodies do not have an internal source of motion and change and are all more or less of the same nature, they require a more perfect original source of motion, which Anaxagoras calls Mind. This Mind, inasmuch as it separated into distinct entities things which were blended together and saw to it that this process of separation from a state in which all things were blended together took place in an orderly fashion, must itself have been inherently blended into one and must have first displayed the formation into distinct entities itself. Such then is Mind, which Anaxagoras conceived of as beginning its work at a certain time, when he said that Mind began to form distinct entities.

It is now clear how Anaxagoras was led to the basic concepts of his theory. From all that has been said it is easy to see that if all things are extracted from each thing, and if each thing is compounded of all things, not only the universe but also each individual object will be infinitely many times infinite, both numerically and spatially.

Aristotle's investigation of Anaxagoras' theory is superficial. In fact, Anaxagoras was a deep thinker who hinted in this theory at a twofold order of the universe:[3] The first is the unified order brought about in pure thought. This precedes the second not in time—for it does not exist in time—but in reality and in power. The second is derived from the first and formed after its pattern. This exists as the result of the workings of Mind, the Creator. I have pointed out these things in my commentary to the first book, where I tried to copy out Anaxagoras' own words in support of this interpretation.

It is in fact plausible that each object has something in common with all other objects and has something of everything in it, as Hippocrates says: All liquids flow together as one, all gases stream together as one, and all things interact with one another; and the reason for this is the original unity of all things in the realm of Mind before they were formed. For although things are now distinct from one another, they are not completely disjoined. It is for this reason that Anaxagoras says that it is not possible for all things to be formed into really distinct entities, for the formation that takes place is not complete disjunction. For the same reason it is not possible for gait or complexion or in general for reactions and states to exist apart from some underlying substance.

If Anaxagoras seems to say that the process of formation began at a certain time, he shared this manner of speaking with the other ancient physicists and theologians, all of whom came down to the level of our weak intellect. For we can not make our minds span eternal time, but we demand to have before us some beginning from which we can observe processes unfolding.

646

Ibid. 461.28 (*On* 203a33)

Aristotle has explained that Anaxagoras was led to posit the existence of infinite extension as a basic concept in his theory because he assumed that the basic building blocks, the homoeomeries, are material and are infinite in number. In this passage Aristotle shows that despite the fact that Democritus did not agree with Anaxagoras that physical change results from a process of extraction, and that each thing is actually compounded of all things, still, by assuming the existence of an infinite number of basic building blocks, the atoms, together with a void, Democritus, no less than Anaxagoras, believed that the basic element which he posited in his theory is infinite in number and is also infinitely extended in contact; for according to him too all parts of the infinite are in continuous contact with one another. . . . It follows in Anaxagoras' theory that the numerically infinite bodies are in contact with one another, as we see from the fact that he said that all things in the universe are together.

647

Ibid. 465.5 (*On* 203b7)

. . . They make infinite matter the only basic concept in their theories and add no other factor in their account of things, in the way that Anaxagoras adds Mind . . . Matter alone, posited as a basic concept, fulfills for them not only the function of the material factor but also of the factor responsible for forming things and bringing them to their perfect final state, the factor Anaxagoras identifies with Mind . . .

648

Ibid. 485.14 (*On* 205b1)[1]

Aristotle has just told us that "matter which is not naturally at rest in any part of space" can not exist, since all matter must have its place of rest; and he has assumed earlier as one of his postulates that every material object has some part of space where it naturally remains at rest. He also postulated that any piece of a homogeneous substance acts in the same way as the substance in mass does, always coming to rest and remaining at rest in the same part of space. Having completed his arguments along these lines and having drawn his conclusions, he now proceeds to examine Anaxagoras' theory, which he finds to be opposed to his.

Anaxagoras said that the infinite mixture of homoeomeries was stationary. He did not however give as the reason for its remaining stationary that it is in the part of space where it naturally remains at rest. Indeed, it is not in any part of space at all because, being infinite in extent, it is not contained in anything—since that which contains something must be larger than that which is contained in it, and something infinite in extent can have nothing larger than it. Therefore Anaxagoras does not say that the infinite mixture was stationary because it occupied that part of space suitable to it by nature, but he says instead that it was in itself and held itself in place.

Aristotle criticizes Anaxagoras for holding the wrong opinion that a thing is wherever it is because it is its nature to be there, and for giving this as the reason the mixture—being in itself and not in a part of space—remains stationary, to wit, that it is in itself by its very nature. This however is not true . . .

Thus Aristotle shows that Anaxagoras' explanation for the state of rest is wrong. Next Aristotle strengthens his point with an argument about parts: Any part of the infinite mixture has the same properties as the whole—because each thing is compounded of all things—and bodies having the same properties remain naturally at rest in the same part of space. Now the entire infinite mixture remains stationary holding itself in place in itself. Therefore it is clear that if any part of the mixture is taken, it too will remain stationary in itself and hold itself in place . . . Anaxagoras, assuming that to say something is contained in itself is the same as saying that it is in the part of space in which it naturally remains at rest, said that the entire mixture was at rest because it held itself in place in itself. . . . This then is the greatest absurdity and the most telling argument against Anaxagoras' view: For he certainly did not say that all existing things are at rest, though they should be according to the apparent meaning of his theory. . . .

This is the argument Aristotle uses against the apparent meaning of Anaxagoras' theory. However if I was right when I said above that Anaxagoras was alluding to a twofold order, a mental one and a perceptible one—the first completely unified and the second divided into distinct entities—then Anaxagoras must have been talking specifically about the mental realm when he said that it is not in any part of space but is contained in itself and holds itself in place in itself; just as he must have been talking about the mental realm when he talked about infinity. For bodies bounded by bounding surfaces were, as it were, brought forth at intervals, and required some other receptacle and some support, which *space* provided for them. For bodies have fallen from their true nature where they were really in themselves, and now exist in space just as they now exist in matter. Things which are not made up of parts and have no gaps in them *are* in themselves and *do* hold themselves in place inasmuch as they are blended together into one. But things which have gaps in them and indiscriminately throw their parts now in one place, now in another, since they are always somewhere else and not here, need the help of space to organize such indiscriminate throwing about of all their parts. But we must go on.

649

Ibid. 522.15 (*On* 208a29)

Change in position is perceived more frequently than other kinds of change. For this reason some people, like Anaxagoras and his school, deny that anything can really be destroyed . . .

650

Ibid. 532.10 (*On* 209a13)

The components of which a composite material body is made up are also material. For a body is directly made up of heat substance, colorless gas, clear liquid, and dry dust; or else, as Democritus says, of atoms; or, as Anaxagoras held, of homoeomeries.

651

Ibid. 553.23 (*On* 210a25)

. . . Anaxagoras . . . says that infinitely extended matter remains at rest because it holds itself in place—that is, because it is in itself and nothing contains it.

652

Ibid. 606.11

In the third book of this treatise, where Aristotle attacks Anaxagoras for having said that infinite matter holds itself in place in itself . . .

653

Ibid. 647.20 (*On* 213a22)[1]

Anaxagoras and his school thought that they could disprove the existence of the void simply by showing that air is something. And in fact by compressing air in wineskins they did show that air is a material substance which can resist pressure. Perhaps however it is more correct to understand Aristotle as saying that they brought out wineskins already inflated, and showed that when they have air inside them it is difficult to twist them; but when they are deflated it is easy.

They also proved by experiment that water can not enter clepsydras—i.e. water clocks—when there is air in them but that when the air is sucked out of them they immediately snatch up the water and do not release it until the finger covering the hole has been removed, allowing the water to stream out as air streams in.

654

Ibid. 652.28 (*On* 213b27)

Above, Aristotle has argued against those who deny the existence of a void—namely, Anaxagoras and his school. Aristotle said that Anaxagoras had to be dealt with first of all, since he proved not that a void does not exist, but that air is something substantial.

655

Ibid. 654.34 (*On* 214a6)

Alexander says that . . . it is like saying that air is a body perceptible only to the touch, for there was a certain theory about the void which held that air is a void perceptible to the sense of touch since it can exert varying pressures. This was the theory that Anaxagoras and his school tried to refute by twisting wineskins.[1]

656

Ibid. 655.16 (*On* 214a6)

. . . If they thought that air is a material substance perceptible to the sense of touch they would not have called the part of space filled with air a void; nor would Anaxagoras and his school have tried to show that a void does not exist by demonstrating that it is a material substance capable of resisting pressure.[1]

657

Ibid. 656.17 (*On* 214a11)

Perhaps the earlier theory really said that air is not material because it can not resist pressure, so that those who adhered to this theory thought that the part of space occupied by air is really a void. In that case, Anaxagoras would be arguing against the adherents of this theory and his demonstration that air was material would certainly be satisfactory.

658

Ibid. 1050.22 (*On* 243a11)

. . . Anaxagoras and his school, and Leucippus and Democritus and their school held that all physical changes result from processes of dissociation and recombination . . .

659

Ibid. 1069.22 (*On* 246b3)

. . . It is not Aristotle's concern to investigate how states come about—whether through the interaction of homoeomeries, as Anaxagoras taught . . .

660

Ibid. 1120.20 (*On* 250b15)[1]

. . . Democritus, Empedocles, and Anaxagoras say that the world was formed in this way, through the motion of its parts. The first two say that atomic particles and the four elementary kinds of matter, respectively, were dissociated and recombined, while Anaxagoras says that the homoeomeries were extracted from the mixture.

661

Ibid. 1121.21 (*On* 250b18)[1]

Anaxagoras, Archelaus, and Metrodorus of Chios seem to say that the world was created at a certain time. They also say that motion and change began at a certain time. They say that before this time all things were static, and that Mind then initiated motion by means of which the world was created. It seems that they too posited a beginning to the creation of the world for didactic purposes. At any rate, Anaxagoras clearly says that Mind gave substance to all the distinct entities in the world, which came out of the mental state of unification in which, as he said, all things in the universe were together.

662

Ibid. 1123.12 (*On* 250b23)[1]

Aristotle describes two ways of conceiving a time during which nothing moves, and he adds the names of the two people, Anaxagoras and Empedocles, who represented these views. . . . Since motion is seen to exist, one of the ways motion might once not have existed is for motion not to have existed before a certain time. This is what Anaxagoras seemed to say, though he was using temporal description only in order to clarify the eternal process in which things of a secondary nature are given substance out of things of a primary nature. . . . Anaxagoras seemed to say that all things in the universe were together at rest for an infinite length of time before; and that Mind, the creator of the world, initiated motion among them in order to form into distinct entities the different kinds of things, which Anaxagoras called homoeomeries.

663

Ibid. 1153.24 (*On* 251b10)

When Anaxagoras says that all things in the universe were together, he too is alluding to a time before distinct entities had been formed and before the world was fashioned; for the word 'were' conveys a temporal meaning. He says that Mind formed things into distinct entities and set them in order after they had been indistinguishable from one another for an infinite time before.

664

Ibid. 1184.19 (*On* 252a5)[1]

Aristotle says that perhaps Anaxagoras gave the very same fabricated reason—that "that's the way it was"—when he said that Mind was the sole originator of motion in the homoeomeries, which were at rest before, giving no additional specific reason why it should have initiated motion at the time it did, and not earlier.

665

Ibid. 1185.9 (*On* 252a5)[1]

Eudemus attacks Anaxagoras for having said that motion began at a certain time and did not exist earlier; and also for having said nothing about the way motion continues and whether it will some day stop; although these things are not at all clear. He says: What prevents us from imagining a time at which Mind stops all things from moving, just as, according to Anaxagoras, it set them in motion? Eudemus brings another charge against Anaxagoras: How can something have been absent before it was ever present? Since rest is the absence of motion it could not have existed before motion.

666

Ibid. 1185.22 (*On* 252a19)[1]

Relationships can be set up between intervals of time, provided they are finite. But there is no relationship between infinite intervals of time, though Anaxagoras seems to deal with them.

667

Ibid. 1186.30 (*On* 252a19)[1]

I have often said that both Empedocles and Anaxagoras were talking about a unified world of thought, in addition to a perceptible world containing objects distinct from each other.[2] Though both worlds exist eternally, Empedocles and Anaxagoras spoke of changes which take place in time, thus alluding to the relationship of these worlds to one another and to the origin of the perceptible world in the world of pure thought.

668

Ibid. 1188.6 (*On* 252b7)

. . . "The infinite mass of matter" refers either to Anaxagoras' infinite mass of matter, as Alexander took it—since a mixture made up of an infinite number of homoeomeries must be infinite—. . .

669

Ibid. 1227.34 (*On* 256b13)[1]

. . . The theory of Anaxagoras . . . took Mind, the source of all motion and change, to be not itself subject to motion and change, and to be free from all admixture and of a pure consistency; because only if the source of all motion and change is itself not subject to any motion or change can it govern all things . . .

670

Ibid. 1254.20 (*On* 259a8)

In the same way, in the first book of this treatise, Aristotle preferred the theory of Empedocles to that of Democritus and Anaxagoras[1]—which held that there are an infinite number of basic building blocks of matter—since Empedocles' theory said that the building blocks are finite in number.

671

Ibid. 1266.33 (*On* 260b7)

Whether physical change is nothing more than dissociation and recombination, as was held by Democritus, Anaxagoras, Empedocles, and all those who assumed that the basic building blocks of matter are not subject to qualitative change, and that all other bodies are composed of these building blocks alone with nothing else added, or whether . . .

672

Ibid. 1318.29 (*On* 265b17)[1]

Anaxagoras' Mind has been imparting order to the homoeomeries and causing them to move ever since the time it began to do this. For this reason it is said to form the homoeomeries into distinct entities.

673

Ibid. 1361.33 (*On* 267b17)

In the first book of the treatise *Foundations of Scientific Thought* Aristotle praises Anaxagoras and his predecessor Hermotimus for not merely having used mechanistic explanations of phenomena, but for having in addition arrived at the concept of Mind, the factor which is responsible for the way things behave and which causes them to reach a perfect final state. Aristotle writes: "The man who first said that Nature possesses a Mind just as animals do, to account for the order of the universe and the order governing its parts, was like a sober man compared to the stammerers who preceded him."[1]

Having said then that Anaxagoras and his predecessor Hermotimus touch on these concepts, Aristotle adds: "Those who say this maintain that Mind, besides being the source of order in all things, is indispensable to an explanation of the behavior of all things, since it is the primary source of motion and change in the universe."

Thus Aristotle praises them for having said that Mind causes things to reach a perfect final state and is responsible for the way they behave, just as he praised Anaxagoras above for having kept Mind free from change and from admixture inasmuch as he said it is the origin of all motion and change.

674

Ibid. 1363.31

Aristotle deprecates Anaxagoras and Empedocles since they are the only ones who seem to say that motion and change are not eternal.

675

Commentary on Aristotle's ASTRONOMY *(In Aristotelis* DE CAELO *Commentaria)* 119.2 (*On* 270b16)[1]

Aristotle takes Anaxagoras to task for having given a wrong etymology for the word 'aether,' when he said that it derives from the verb *aithein*, which means "to burn." Aristotle also censures him for taking the etymology of the word seriously and using the word to mean 'heat.' The etymological meaning of the word does not indicate its meaning in fact; if it did, we too would call heat 'aether.'[2] For what is the use of having two words for one thing? One of the concepts would simply be obscured.

676

Ibid. 202.20 (*On* 271b1)

. . . Some, like Anaxagoras, deny the existence of physical change, and say that all things receive their substance through a process of extraction.

677

Ibid. 229.33 (*On* 274b8)

. . . Anaxagoras seemed to say that there are an infinite number of homoeomeries of each kind of thing . . .

678

Ibid. 305.20 (*On* 279b32)

Plato, Empedocles, Anaxagoras, and the other natural philosophers appear to have taught that composite bodies are formed out of simple ones in the manner postulated: starting from objects which happen to be at hand at any given moment they follow in detail the processes through which composite bodies are broken down into and compounded from simple ones, assuming always that the material components of which things are formed were present before the things were formed.

679

Ibid. 374.32 (*On* 284a14)

Some people say that a physical mechanism keeps the sky from falling—namely, the action of a vortex which holds it up—since the downward pull on the heavens is less than the force exerted by the vortex. Empedocles and Anaxagoras say this.

680

Ibid. 375.25 (*On* 284a14)

It is not true, either, that the rotation of the heavens and the fixed position of the earth at the center go on forever because they are maintained by the swift rotation of the aether, whose motion is more rapid than the downward tendency of the heavens and of the earth, which arises from the heavy downward thrust they naturally exert. This is what Empedocles seemed to say, as well as Anaxagoras and Democritus.

681

Ibid. 511.22 (*On* 293a15)

. . . But most of those who say that the universe is finite in size hold that the earth lies at the center; Empedocles, Anaximander, Anaximenes, Anaxagoras, Democritus, and Plato hold this view.

682

Ibid. 520.28 (*On* 294a11)[1]

Third, Aristotle mentions those who say that the earth remains at rest because it is supported by the air beneath it. They say that the earth, being flat like a stretched membrane, covers the air beneath it as a pot-cover would, preventing the air from escaping. This seems to be the opinion of Anaximenes, Anaxagoras, and Democritus.

683

Ibid. 526.34 (*On* 294b23)[1]

Aristotle has said in the meanwhile that all those who taught that the world was created said that earth came to the center because of the rotation of the heavens. For not only Empedocles, but Anaxagoras and his school said this.

684

Ibid. 527.31 (*On* 294b23)[1]

Aristotle has said that Anaxagoras and his school, as well as Empedocles and his, say that earth came to the center because of a vortex. The former however give the flatness of the earth as the reason it remains at rest, while the latter give a vortex.

685

Ibid. 543.3 (*On* 297a8)

Assuming then that earth had been mixed together with everything else before that time, and was then separated out, as Anaxagoras seemed to say . . .

686

Ibid. 589.25 (*On* 301a11)[1]

Here Aristotle praises Anaxagoras because he did not say that the world was created out of entities which were moving about and already distinct, but out of entities which were at rest and blended into one. Anaxagoras said that all things in the universe were together, and that Mind formed them into distinct entities and set them in order . . . However the praise Aristotle gives Anaxagoras is only for having held that the universe was formed out of components which were at rest and blended into one. Aristotle adds the reason for this in what follows: if the world were indeed composed of completely distinct building blocks, and was really created, then it would have had to be created from a state completely different from its present one. Thus the world, if it was created, must have been created out of a blended and hence unified state.

687

Ibid. 601.1 (*On* 302a10)

. . . It follows from theories like those of Empedocles and Anaxagoras, which ascribe physical change to dissociation and recombination, that the basic kinds of matter must actually be present always . . .

688

Ibid. 603.4 (*On* 302a28)[1]

Aristotle has stated that colorless gas, heat substance, and the other kinds of matter which Empedocles calls elementary, are in fact elementary. Next he tells us that Anaxagoras' theory holds the opposite view, not with respect to the definition of an elementary kind of matter —for everybody agreed that an elementary kind of matter is something existing in an object into which the object can be broken down, but not itself further reducible into components having properties different from its own—but with respect to the kinds of matter which have the property of being elementary. Empedocles said that this property resides in the four, and called them elementary forms of matter; Anaxagoras said this property resides in the homoeomeries; Thales said it resides in clear liquid; and in general each thinker said it resides in something else. Everybody used the same criterion, but each one came up with his own set of elementary kinds of matter, saying that they could be extracted from other things, but nothing could be extracted from them. This is what led Empedocles to say that the four are the elementary kinds of matter; while Anaxagoras for the same reason called homoeomeries like flesh, bone, and such things, basic particles, and held Empedocles' elementary kinds of matter—i.e. colorless gas, heat substance and the rest—to be compounds made up of all the homoeomeries collected together, though they do not seem to be made up of homoeomeries because the homoeomeries are invisible and imperceptibly small.

Furthermore Anaxagoras often uses the word 'aether' for fire.

Aristotle has thus set out the opinions of each of them concerning the elementary kinds of matter. In doing this he has also told us that they disagree: Empedocles says that all the homoeomeries are composed of the four, and that these four are the basic building blocks of all things. Anaxagoras on the other hand says that these four kinds of matter and all other things are composed of the homoeomeries, and that these homoeomeries themselves are in turn composed of homoeomeries.

689

Ibid. 604.28 (*On* 302b13)[1]

Among those who held that there are an infinite number of elementary kinds of matter, Leucippus and Democritus postulated the existence of an infinite number of atoms, while Anaxagoras and Archelaus assumed the existence of an infinite number of homoeomeries. Aristotle attacks the latter opinion first. He has argued against it previously in the first book of the *Physics*, but he speaks against it here too and disproves the theory of those who held that all the homoeomeries are elementary kinds of matter.

Indeed even composite substances can be homoeomerous, though they are not elementary kinds of matter. For a homoeomery is by definition something which can be subdivided into components similar to the whole, as is the case with a piece of flesh, bone, wood, and stone, which are obviously not simple substances. For, as Aristotle has said, the simple substances, heat substance, dry dust, and the intermediate ones, can be extracted out of the above-listed substances, which are formed from several kinds of matter. Those substances increase in size through the addition of various kinds of added materials; wood contains some dry dust, some colorless gas, and some clear liquid; and no stone lacks clear liquid since dry dust can not cohere without liquid. Anaxagoras however says that these four are not elementary kinds of matter, though they are homoeomeries.

690

Ibid. 605.31 (*On* 302b20)[1]

. . . Anaxagoras said that the four basic kinds of matter are compounded out of homoeomeries. In the same way he says that all perceptible bodies are compounded out of homoeomeries, each object receiving its characteristic properties from the predominant component in it.

691

Ibid. 608.11 (*On* 302b30)

In what preceded[1] Aristotle has argued against Anaxagoras' theory along these lines. In the first book of the *Physics* he also attacked Anaxagoras for saying that all things are compounded of all things. Anaxagoras said that each perceptible object contains in it an infinite number of homoeomeries, and that this explains why all things are seen to come out of all things . . .

Anaxagoras says in the beginning of his book: All things in the universe were together, infinitely many and infinitely small. For the small was infinite. Nothing could be discerned in the universal mixture because the pieces were minute. And he says that we must conceive all things in the universe to be one. Perhaps when he speaks of infinity, he means something which we cannot grasp or know. He alludes to this interpretation in the words: So that it is impossible to know the number of the separate entities, either theoretically or actually. He also made it clear that he thought that there is a finite number of different kinds of things when he said that Mind knows and perceives all things; for if there were really an infinite variety of things they would be completely unknowable, since to know is to encompass and outline that which is known.

Anaxagoras also says: And Mind knows and perceives all things: those in the mixture and those separated out, the kinds of things which were going to exist and those which have existed. It is probable that Anaxagoras was alluding to two realms of order: to one, a unified mental one, in which all things in the universe are together, and in which each thing is everything else through the unifying power of Mind; and to a second, perceptible and set apart from the state of unity by the action of Mind in its role as Creator which, he says, issued forth out of the Mind in the mental realm and set all things in order. For I think the following words show that he is hinting at a certain order in the mental realm which is prior to the order in this perceptible world—prior in the sense of being responsible for its existence, as well as in the sense of its possessing fully formed a complete picture of the perceptible order: Therefore one must conceive that many different kinds of things, particles of all substances, possessing all features, tastes, and colors are present in the universal mixture. And men and all other animals—those things which have life—were formed. And these men had incorporated towns and suitable employment, just as we have; and sun, moon, and other heavenly bodies, just as we have; all these things clearly being there as in a mental pattern conceived, as he said, the way pure predicates are.[2]

692

Ibid. 609.16 (*On* 303a3)

. . . And Aristotle has argued against Anaxagoras and his school, who say that the basic building blocks of matter are an infinite number of homoeomeries.

693

Ibid. 613.7 (*On* 303a29)

It was not necessary in Anaxagoras' theory to posit an infinite number of basic building blocks of matter, since he held that the homoeomeries differ from one another in their properties; and it has been shown that the number of different kinds of properties is finite, because only a finite number are perceptible.

694

Ibid. 614.24 (*On* 303b4)

Aristotle has presented many arguments against those theories which hold that the basic building blocks of matter are infinite in number. This includes the theory of Anaxagoras, who said that they are homoeomeries, and that of Democritus . . .

695

Ibid. 632.2 (*On* 305a33)

There are also different opinions concerning the mechanism of physical change: . . . Anaxagoras said that all things are compounded out of all things, and held that physical change is a process of extraction . . . Therefore Aristotle first refutes Empedocles, Democritus, Anaxagoras, and their various schools since they hold in common the opinion that the elementary kinds of matter—which are different for each of them—are eternal and do not really undergo physical change, but only seem to when they are dissociated from one another . . . Anaxagoras said that not only the four kinds of matter, but also all other kinds of matter are elementary,[1] calling them homoeomeries. He said that all things are compounded out of all things and have their characteristic properties determined by the predominant component in them. Thus, for example, when many little particles of fire are separated out and gathered together, fire appears.

696

Ibid. 634.21 (*On* 305b10)

. . . that a void does not exist at all . . . and matter retains all its properties even when it is mixed together with other matter, as Empedocles and Anaxagoras taught—for they are the ones meant by "anyone who takes this view" . . . If this interpretation is correct then in the first part of the argument Aristotle is attacking Anaxagoras and Empedocles, who denied the existence of the void, and in the second part Democritus . . .

697

Ibid. 635.1 (*On* 305b20)

In this argument Aristotle refutes the theory that physical change is a process of extraction, and that therefore all things actually exist in all things, as Anaxagoras held. Indeed Aristotle has used this argument against Anaxagoras in the first book of the *Physics* too. There he was investigating the basic building blocks of matter, while here he is investigating the manner in which these basic building blocks change into one another.

Aristotle says then that if physical change is a process of extraction, and if therefore all things are in all things, any process in which things change into one another must come to a halt. This conclusion however was most unwelcome to those who held this theory. Aristotle proves it with the aid of the theorem that there cannot exist an infinite number of bodies of finite size in a finite volume.

Aristotle is justified in arguing against the existence of an infinite number of bodies of finite size. For even though bodies can be subdivided indefinitely, it is one thing to be indefinitely subdivisible potentially, and quite another thing to be actually composed of an infinite number of parts. To be indefinitely subdivisible potentially is to be continuous; but things which are actually composed of an infinite number of parts, as Anaxagoras assumes, must be composed of parts of finite size; otherwise they could not be joined together to form a single whole, since they would not have any properties in common. Since then an aggregation of an infinite number of bodies of finite size occupies an infinite volume, an object which is not infinite in volume, but finite, could not possibly be made up of an infinite number of bodies of finite size—that is, bodies which are actually distinct.

698

Ibid. 673.4 (*On* 307b19)

Having refuted Anaxagoras and Democritus and their schools, who say that there are an infinite number of basic kinds of matter, Aristotle goes on . . .

699

Ibid. 686.12 (*On* 309a19)[1]

Aristotle says that some of those who, like Anaxagoras and Empedocles, denied the existence of a void, do not account for the distinction between light and heavy . . .

700

Commentary on Aristotle's PSYCHOLOGY (*In Libros Aristotelis* DE ANIMA *Commentaria*) 25.8 (*On* 403b28)

Perhaps the words "some people" refer to Anaxagoras, who did not express himself clearly when he identified Mind—which he says is the source of all motion and change—with life.

701

Ibid. 26.36 (*On* 404a24)[1]

Aristotle has mentioned that Anaxagoras said Mind is responsible for all motion and change, and also that he said life originates motion and change. . . . Aristotle says that nevertheless Anaxagoras did not completely equate Mind and life. Sometimes he is not clear, and at other times he seems to contradict himself. Sometimes he says that Mind brings about nothing more than true knowledge, so that it is somehow distinct from life, which can not grasp the entire truth but only as much of the truth as is accessible to its highest capacity; but sometimes Anaxagoras says that Mind is present in all animals, thus equating it with life since life, not Mind, is present in all animals—unless one is willing to call the ability to form images 'Mind'.

702

Ibid. 30.28 (*On* 404b30)

The natural philosophers assumed that only material elements exist. The Pythagoreans and Plato said that only incorporeal elements exist. Empedocles and Anaxagoras said that both kinds exist.

703

Ibid. 31.13 (*On* 405a13)[1]

Because—as Aristotle has said before—Anaxagoras alone said that Mind is responsible for things being in perfect order, he "treats them[2] as if they were the same" since he holds that Mind resides in all animals, "except that he holds that Mind bears the primary responsibility for all things." Indeed Anaxagoras praised Mind in distinct terms far more than other things, saying that it is free from admixture and that it transcends all things and is responsible both for knowledge and for motion and change.

704

Ibid. 33.16 (*On* 405b12)[1]

Aristotle excludes Anaxagoras alone from the list of those who think that something can be perceived only by something else similar to it. This is not because Anaxagoras held that the ability to know and perceive is not one of the basic faculties—for certainly he identifies this faculty with Mind—but because, as Aristotle clearly adds, he does not think that knowledge is attained through a similarity between the object perceived and that which perceives. For Anaxagoras says that Mind is free from admixture with anything else and has nothing in common with anything else, and that other things do not even have Mind in them—since this is what the phrase 'free from properties'[2] means—but still Mind knows and perceives everything.

705

Ibid. 226.10 (*On* 429a18)[1]

. . . Anaxagoras' theory keeps Mind free from admixture with the homoeomeries, in order that it may master them all—both that Mind which creates all things and thinks transcendently, and the Mind in matter, the Mind of living creatures, subordinate to it.

706

Ibid. 235.7 (*On* 429b22)[1]

. . . Mind can not be affected, as Anaxagoras also believed . . .

707

Commentary on Epictetus' HANDBOOK (*Commentarius in Epicteti* ENCHIRIDION) On Chapter 16

When Anaxagoras heard that his son had died he said calmly and nobly, "I knew he was mortal when I begot him."

Part Three

The Ancient and Modern Traditions About Anaxagoras

> *The state of affairs Anaxagoras speaks about would then prevail, my dear Polus—and you are well acquainted with that state: all things would be mixed together into one big mess . . .*
>
> Socrates, in Plato *On Rhetoric*
> 465d2–5 (source 10)

Chapter One

ON THE RELIABILITY OF THE SOURCES

No book or extended essay written by Anaxagoras has survived. Our picture of Anaxagoras and his work depends entirely upon secondary sources. Therefore the central problem facing any student of Anaxagoras is the reconstruction of his physical theories from the writings of others. Any attempt to solve this problem must begin with a clear idea of how the sources collected in Part II are to be treated.

A trustworthy secondary source for the scientific theories of Anaxagoras should fulfill both of the following conditions: (1) its author should have been a student of Anaxagoras or should have heard his theories from others who had studied with him *and* he should have read his writings carefully; failing that, its author should have *either* read the writings of Anaxagoras, *or* been in a position to hear the views of Anaxagoras expressed by those who preserved a direct tradition of these views; (2) the picture it presents of Anaxagoras' theory should be free from internal contradictions. If a source fulfills neither of these conditions, it must a priori be considered inadmissible as evidence.

None of the authors of the sources brought in Part II was a contemporary of Anaxagoras. Thus the reliability of any given source depends on whether or not its author had Anaxagoras' writings and could draw from a living tradition of his teachings. We shall see in Chapter 3 below that it is highly improbable that anyone after the third century B.C.E. had Anaxagoras' works, and that the purported quotations from his writings appearing in later authors were isolated statements picked out of context, and having little claim to be genuine. Moreover, it seems that no direct living tradition of Anaxagoras' teachings survived the end of the fourth century B.C.E. It is well known that the end of the fourth century and the beginning of the third marks a turning point not only in the political realm but also in the realm of thought and writing. It was a time in which many traditional patterns of Greek culture were destroyed. The wealth of the city-states in Greece was drained away, their populations reduced, and their peace disrupted by incessant wars and turmoil. City-states everywhere took second place in importance to world empires. New schools and cultural centers were established in Egypt and Asia, and in all the schools, new and old, new systems of thought gained the center of the stage, outstripping old systems in importance and popularity. Even Plato and Aristotle received little attention, and the doctrines of their predecessors were all but forgotten. The followers of Anaxagoras, mentioned by Aristotle as a group to be contended with even in his time, were no longer heard of. (Later authors who speak of them are clearly referring to the past, and drawing mostly on Plato and Aristotle.) The third century B.C.E., then, saw the end of virtually all the direct traditions transmitted from the presocratic philosophers through succeeding generations of disciples, and the direct tradition about Anaxagoras' teachings ended too. The latest sources fulfilling the first condition, and hence the last sources that have a claim to trustworthiness, are those from Theophrastus.

New information about Anaxagoras does occur in sources later than Theophrastus. This new material belongs to one of two categories: either it consists of explanations and expansions of the older, reliable texts, in which case the later sources can certainly not be held to be preferable to the older texts (see the Chapter 2 ahead); or else the new material has no echoes in earlier texts available to us. None of the new material that has no echoes in earlier texts touches on the basic concepts of Anaxagoras' theory. None of the later sources alters in any way the picture of Anaxagoras' basic theories given in the sources up to and including Theophrastus. (The only exception to this rule are new presentations containing obvious anachronisms, and written with the purpose of fitting Anaxagoras into the framework of a later system espoused by the writer. For example, Anaxagoras' Mind later became identified with God, and the distinction he drew between Mind and matter becomes for the Neoplatonists the distinction between the realm of pure predicates and the realm of perceptible objects. Such anachronisms are easily spotted, and they really belong in the category of expositions of the meaning of earlier texts.) The new material which has no echoes in earlier sources is limited to a few detailed theories given in Anaxagoras' name, and some particular sayings attributed to him. In the case of the detailed scientific theories we have felt obliged to suspend judgment. We do not consider the sources in which they occur to be really reliable, because where we can check these sources against the early sources we often find them to be wrong. It is, of course, possible to conjecture that these theories derive ultimately from a lost source which did fulfill the conditions established above, but such hypothetical reconstruction can not serve as evidence for their reliability. The situation is that of the historian who finds himself faced with new bits of information appearing for the first time in writings dating from hundreds of years later than the era he is studying. If he has no way of tracing them back to the period in which he is interested, and no indication that the writer who introduced these new bits of information had genuine access to original sources from the period he is studying, he has no alternative but to consider this material with suspicion and to omit it from any study whose basis is only in fact. In our case it is certainly possible that any particular one of these detailed theories is genuine. Our omission of this material from our account in Part I indicates only that we have no way of verifying their authority. As for sayings attributed to Anaxagoras and stories about his life, which neither appear in early sources nor can be traced back to them, the situation is similar. We have suspended judgment on such biographical material and omitted it as well.

It is clear, then, that the author to whose presentation of Anaxagoras' theories most weight must be assigned is Aristotle,[1] and that the other early sources, namely Plato, Xenophon, Isocrates, Demosthenes, and Theophrastus, must also be granted considerable trust. Of these sources, all but Theophrastus fulfill both the conditions established above for reliability. Theophrastus fulfills only the first,[2] but it is still possible to learn from him, and to make use of the information he gives.

Chapter Two

ANCIENT TRADITIONS ABOUT ANAXAGORAS

In this chapter a number of traditions about Anaxagoras in the ancient sources will be traced through a thousand years of growth, development, and expansion. We have not followed every tradition, but only those which illustrate the way the *transmission* of information over centuries affects the *content* of the information transmitted. The reader who wishes to follow other traditions in the sources can refer to the Index, where the sources dealing with every subject mentioned in the ancient tradition can be found. In this chapter source numbers will appear in parentheses, references to modern works in square brackets.

1. Reliable Traditions

There are a number of traditions about Anaxagoras and his teaching which occur in the earliest sources and are preserved essentially unchanged over the next thousand years. This category includes material which is generally associated with the name of Anaxagoras and which frequently appears in stereotyped formulation when Anaxagoras is discussed as an important figure in the history of ideas. For the most part it consists of bare statements made without explanation or elaboration and often without any real comprehension. Such, for example, are the statements that Anaxagoras was the son of Hegesibulus; that he came from Clazomenae; that his theory discussed Mind; that his theory discussed homoeomeries (see Note 1 to source 17, and Note 1 to source 97); that he said, "All things together"; that he held that physical change comes about by dissociation and recombination; that he held that something can not come out of nothing; that he believed the world was formed by Mind out of an original chaotic mixture.

Other traditions, concerning detailed theories, are also preserved intact in the sources. For example, that Anaxagoras believed:

a) that the earth is flat can be found in Plato (an allusion in 3); Aristotle (29); Origen (Hippolytus?) (271); Alexander (292); Diogenes Laertius (340); Themistius (416); Martianus Capella (433); Simplicius (682);

b) that air resists compression and that there is no void can be found in Aristotle (23, 29, 57); Cicero (an allusion in 93); Plutarch (170); Galen (226); Origen(Hippolytus?) (271); Eusebius (411); Philoponus (525); Simplicius (653–657);

c) that the aether occupying the upper regions is fiery can be found in Aristotle (28, 31, 35); Theophrastus (91); Plutarch (166); Galen (222); Origen(Hippolytus?) (271); Alexander (283, 293); Diogenes Laertius (340); Eusebius (379); Themistius (415, 422); Stobaeus (482); Philoponus (543); Olympiodorus (603, 604); Simplicius (623, 635, 675, 688);

d) that the Milky Way is the light of those stars which lie in the shadow of the earth when the sun is under the earth at night can be found in Aristotle (37); Plutarch (173); Galen (229); Origen(Hippolytus?) (271); Alexander (287); Diogenes Laertius (340); Stobaeus (488); Philoponus (545); Olympiodorus (606, 607);

e) that comets are conjunctions of planets can be found in Aristotle (36); Plutarch (174); Galen (230); Alexander (284–286); Diogenes Laertius (340); Stobaeus (489); Philoponus (544); Olympiodorus (605);

f) that all animals possess Mind, as do plants (which must be considered animals) can be found in Aristotle (41, 52–54); Plutarch (184, 187); Themistius (425, 428); Philoponus (550, 553); Asclepius (568); Simplicius (701, 703, and compare 700);

g) that the cosmic Mind is analogous to the mind of animals can be found in Aristotle (61); Cicero (108); Alexander (299, in a very confused passage); Augustine (438); Simplicius (673);

j) that man is the wisest of animals because he has hands can be found in Aristotle (48); Plutarch (150, 156); Galen (214).

2. Expanded Traditions Based on Reliable Data

Many traditions which go back to the earliest sources preserve their original content despite subsequent development. The following are examples of these:

a) Anaxagoras and Pericles. Plato (7, 13) tells us that Anaxagoras was often mentioned as Pericles' close associate and teacher, and that Pericles had learned from him about nature and about Mind, thus acquiring much of the material he used in his speeches. Plato's account, though bitingly sarcastic, was read as straight-forward praise in later ages. Isocrates (15) and Demosthenes (16) also mention the relationship between the two men, and others who simply note it are

Philodemus (113), Quintilian (145), Eusebius (369), and Proclus (465). Cicero (99, 104) tries to reconcile the fact that Pericles became a good rhetorician as a result of Anaxagoras' teaching with the fact that Anaxagoras was not a rhetorician, and so he explains that, though the matters Anaxagoras taught were abstruse and recondite, Pericles' own genius allowed him to apply them easily to the field of rhetoric. Valerius Maximus (133, 134) is the first to specify the kind of aid Anaxagoras' teaching gave Pericles in his dealings with the Athenians. Here, Anaxagoras' teachings about the sun and the moon are shown to have been of specific advantage to Pericles by enabling him to sway the minds of the Athenian public and prevent panic during an eclipse of the sun. Plutarch (159, 191, and especially 192–194) elaborates on the relationship by giving numerous examples of the ways in which Pericles benefited from Anaxagoras. In (193) he cites explicitly the sentence from Plato which allowed him to trace directly every good quality that could be found in Pericles to the influence of Anaxagoras. The nature of the relationship is elaborated by showing that Pericles was concerned for the welfare of his former teacher to the point of giving him financial support when he lay destitute. Lucian (202) shows Pericles in the role of Anaxagoras' protector even against the wrath of Zeus. The relationship between the two is so well known that it can be used even in comic writing. Aelius Aristides (207, 208, 210) quotes Plato, and, like Plutarch, assumes that Anaxagoras' teaching prevented Pericles from being corrupted by power. In Diogenes Laertius (340) we read (in the name of various authors from the third century B.C.E.) that the bond between the two men was so close that Pericles' political fate was shared by Anaxagoras. Here we find political charges brought against Anaxagoras by people aiming at Pericles, and Pericles protecting Anaxagoras loyally through all his trials. The Emperor Julian (391) considers Pericles a prime example of a well-educated politician, and therefore similar to himself. Accordingly he paints a grandiose picture of Pericles' departure from Anaxagoras and compares it to his own departure from Sallust. Olympiodorus (599, 603) adds that Pericles defended Anaxagoras so well that he achieved his recall from exile.

Thus over the course of the years a few simple remarks in Plato are expanded and combined with other motifs until the relationship with Pericles comes to figure as an important factor in Anaxagoras' life, while every moral perfection of Pericles becomes the result of Anaxagoras' teachings. Later still the theme of Pericles' gratitude to Anaxagoras is emphasized and the relationship between the two men becomes more an example of Pericles' magnanimity than an explanation for his wisdom.

b) Anaxagoras' neglect of his inheritance. Plato (12) tells us that Anaxagoras was the heir to a large sum of money which he subsequently lost because he was foolish in practical matters and neglected his property. Cicero (107) adds color to the story by describing the property Anaxagoras lost, and by giving a reason which he feels is more in consonance with Anaxagoras' character as Cicero (101) presents it. The reason for the loss was not foolishness, of which Anaxagoras could not be accused, but rather Anaxagoras' great devotion to learning, which left him no time for practical matters.

The story thus becomes a moral lesson in praise of the pursuit of knowledge as compared with the pursuit of money. In Philo (126, 129) the picture of the moral excellence of our impractical philosopher is further embellished, and there first appears here the phrase later frequently used to describe Anaxagoras' treatment of his property, that he allowed his property to become pastureland. Philo imagines that nevertheless the good Anaxagoras ultimately benefited, since the result was that his herds flourished! In addition Philo pictures Anaxagoras as not only neglecting his property, but consciously banishing from his presence material things. In Valerius Maximus (132) the moral is slightly shifted. Here we find that the neglect which Anaxagoras' property suffered came about because he went abroad to study. Anaxagoras' love of learning is now reflected in his willingness to spend many years abroad away from home, even at the cost of seeing his property neglected, in order to gain wisdom through study. Plutarch (160, 194) repeats the bare formula that Anaxagoras abandoned his land to be pasture for sheep, and then adds, as is his custom, an extended moral discourse on the contrast between the life of the abstract thinker and the life of the practical man. For Plutarch the contrast is so extreme that Anaxagoras is pictured as incapable of caring for his daily food without the constant attention of Pericles! In Maximus of Tyre (205) the contrast between the theoretical and practical life becomes the basis for a long, imaginative rhetorical exercise which assigns to Anaxagoras all the conceivable aberrations of an asocial being and of an impractical philosopher. Diogenes Laertius (340) presents still another version, in which Anaxagoras' neglected possessions are shown to devolve upon his relatives, and the act of abandonment of his property to his relatives is turned into an illustration of Anaxagoras' magnanimity in giving things away. For Philostratus (263, 266) (whose aim is the glorification of Apollonius of Tyana) Anaxagoras' abandonment of his property is no longer praiseworthy. Here we learn that Apollonius did give his property to his relatives, while Anaxagoras did not, but abandoned it to cattle and to sheep instead. The last mention of this story appears in Eusebius (372) where the fact that Anaxagoras neglected his property is brought as proof that his devotion to philosophy was greater than that of any of his predecessors.

Thus the original simple statement in Plato appears in many different versions, none far-fetched, and all vehicles for some type of moral lesson.

c) Anaxagoras avoided public affairs. Plato (11) tells us that Anaxagoras avoided political affairs, and Aristotle (80) contrasts Anaxagoras' cleverness in abstract matters with his lack of interest in the study of human affairs. Cicero (98) adds the observation that the country in which Anaxagoras lived must have suffered by his withdrawal from political life. In the rhetorical exercise of Maximus of Tyre (205) this statement of Cicero's is greatly expanded and the country is specified as Clazomenae. Diogenes Laertius (340) records that Anaxagoras explained his lack of interest in politics by declaring that he was a citizen of the world rather than of any particular state. The last mention of the subject is in Eusebius (370).

d) Anaxagoras' view of the aim of life. We are told by Aristotle (83) that Anaxagoras said that the aim of life is the contemplation of the "cosmos." For Philo (127) the story is of use only as an example of how the word "cosmos" can be used in the sense of the heavens, since according to him Anaxagoras was looking at the heavens when he stated that he was contemplating the "cosmos." Anaxagoras' devotion to the observation of heavenly phenomena is made vivid by the statement that he would often try to spend the whole night out of doors looking at the sky.

Clement of Alexandria (254) relates Anaxagoras' view of the aim of life to the picture of Anaxagoras as one who is not concerned with human affairs. Diogenes Laertius (340) relates the story twice, once in a collection of Anaxagoras' sayings, and again in connection with Anaxagoras' abstinence from public affairs. Lactantius (357, 358, and especially 356) takes Anaxagoras' view as the text for a long sermon against materialism. According to him Anaxagoras was blind in thinking that the purpose of life was to contemplate physical objects rather than the God who had created them. In Lactantius Anaxagoras is quoted as saying that the purpose of life is to contemplate the sky and the sun, rather than the entire heavens. Iamblichus (366) has a new phraseology, which seems to be an attempt to combine all versions, leaving nothing out. He too disapproves of Anaxagoras' choice of objects worthy of contemplation. Chalcidius (388) on the other hand approves the choice, because he identifies the vaults of heaven with the realm of pure predicates, and so pictures Anaxagoras as being in fundamental agreement with Neoplatonic philosophy. His version of the story leaves out all dialogue and has Anaxagoras merely pointing toward the heavens when asked what the purpose of life is. Theodoretus (459) repeats Clement's story and follows it with praise of Anaxagoras.

e) Anaxagoras' view of the wise and happy man. Aristotle (81, 82) tells us that Anaxagoras said that the truly wise or happy man would seem to be ridiculous to most people, since he would not desire riches, power, good looks, or any of the other superficial benefits which most people seek. Valerius Maximus (131) relates that Anaxagoras said the happy man is one who lives modestly within his own confines, pursuing either the Roman ideal of small agriculture or the Greek ideal of learning. Maximus of Tyre (205) accentuates Anaxagoras' retirement from public affairs and from the pursuit of power as the main feature of his idea of happiness.

f) Anaxagoras at Lampsacus. Aristotle (84) quotes Alcidamas to the effect that the people of Lampsacus gave Anaxagoras a funeral and honored him after his death. Cicero (105) presents a developed picture of Anaxagoras dying in a strange land far from home. He tells of a dialogue at Anaxagoras' deathbed, in which friends of the dying man discuss his burial far from home. Diogenes Laertius (340) has many details to relate concerning Anaxagoras in Lampsacus. (He does not, however, associate the story told by Cicero with *Anaxagoras'* death. In Diogenes' account Anaxagoras is discoursing with someone else who is dying in a foreign land.) He speaks of the fine funeral Anaxagoras received, and quotes an epitaph purportedly inscribed on Anaxagoras' tomb at Lampsacus. He also tells an anecdote which reveals not only the honor paid Anaxagoras, but also Anaxagoras' humility: that when Anaxagoras was asked what honor he wished for himself, he requested that the month of his death be given in perpetuity to the children of Lampsacus as a vacation from school. Eusebius (369) speaks of the continuation of Anaxagoras' school at Lampsacus after his death. This is the first we hear of a school set up by Anaxagoras there in his declining years. The account is combined with the tradition that Archelaus was Anaxagoras' successor, and Eusebius concludes that Archelaus must have been at Lampsacus to take over the school at Anaxagoras' death.

g) Anaxagoras did not use Mind to explain the workings of particular phenomena. Plato (3) and Aristotle (62) tell that even though Anaxagoras introduced Mind as the factor responsible for the behavior of all things, he preferred to explain specific physical phenomena in mechanistic terms. Clement of Alexandria (253) says that Anaxagoras used "foolish eddies" to assist idle Mind. For Plotinus (277) the criticism of Anaxagoras is that he does not elevate Mind above the level of matter. Eusebius (372) and Proclus (463, 466) repeat Plato's criticism, and Themistius (408) echoes Aristotle's remarks (see also source 20). Philoponus (512, 514, 541, 542) mentions the homoeomeries specifically as the material factors used by Anaxagoras in his explanations in place of Mind. Asclepius (572) and Simplicius (612, 633, 639, 640, 643) repeat the earlier criticism. Simplicius adds a passage ascribed to Eudemus which says that Anaxagoras had things occur automatically on their own, rather than through the agency of Mind. (Compare source 20, and also source 633, where automatic behavior is called characteristic of all early physics.)

h) Mind is infinite. In Aristotle's accounts of Anaxagoras' theories, mention is frequently made of the fact that for Anaxagoras the universe was infinite (see sources 21, 22). Since Mind controls the entire universe, it is clearly implied that Mind is not limited in its domain but has unbounded rule. The first explicit statement that Mind is infinite occurs in Cicero (108), where Mind is called infinite with no further elaboration. Minucius Felix (275) identifies infinite Mind with God, as does Lactantius (355). Augustine (438) discusses the Cicero passage in detail, stressing that Mind is infinite not in the extensive sense but in power. For Augustine too Anaxagoras' Mind was God. Simplicius (623, 626) ascribes to Anaxagoras the explicit statement that Mind is unbounded.

i) The composition of the sun and the stars. Plato (1) and Xenophon (14) tell us that Anaxagoras held that the sun is a fiery stone, and Pliny (141) repeats this. Josephus (143) reports that Anaxagoras considered the sun a red-hot mass of ore. Plutarch (168) says that according to Anaxagoras the sun is a red-hot piece of stone *or* ore. In (166) and (196) he adds that the stars too are red-hot stones, and that they were snatched up from the earth by the whirling aether and shine because they force their way through the heat in the aetherial region. Galen (222–224) repeats Plutarch's statements in (166) and (168). Origen (268) has the sun, the moon, and the stars all red-hot masses of ore in Anaxagoras' theory. According to him (Hippolytus?) (271), for Anaxagoras the sun and the moon and the stars are all fiery stones which have been snatched up by the rotation of the aether; but the heat of the stars is not felt because they are too far from the earth, and because they are not as hot as the sun, being in a cooler place. Diogenes Laertius (340) speaks of the sun as a red-hot mass of ore and suggests that Tantalus preceded Anaxagoras in holding this view. Diogenes also quotes Silenus as having written that Anaxagoras said that all the heavenly bodies are made of stone. Harpocration (279) mentions only that the sun was a red-hot mass of ore for

Anaxagoras, while Eusebius again repeats the statements of Plutarch (166 and 168); according to Augustine (435) the sun is a red-hot mass of *stone*, and Cyril of Alexandria (440) concurs. Theodoretus (450, 455) quotes Xenophon (14), and then reports that Anaxagoras said that the sun is a fiery mass of ore *or* stone. He also says that Anaxagoras thought the stars are stones which were drawn up by the rotation of the universe, and burst into flame; he does not give any reason for their burning. Stobaeus (482, 483) too says that the sun is a red-hot mass of ore or of stone, and that the stars are stones which were snatched up from the earth by the rotation of the aether; he adds that they burn because they were set on fire by the aether. Lydus (597) says simply that the sun is a fiery stone. Olympiodorus (603) explains that the statement that the sun is a red-hot mass of ore means that the sun is iron which has been turned in the fire.

Anaxagoras' statement that the sun is a fiery stone thus comes to include the stars, and the bare statement occurs in another version in which the sun is said to be a red-hot mass of ore. Since metallic ores are kinds of stone which are often seen glowing in furnaces, these two versions are essentially the same.

j) The nature of the moon. Plato (1, 2) says that Anaxagoras held the moon is earth and shines by the reflected light of the sun. According to Plutarch (171, 172), Galen (227, 228), and Eusebius (387, 382), the moon is a fiery solid body which has on it plains, mountains, and gullies, and is composed of an uneven mixture of fiery and murky substance. In Origen's account (268) the moon is simply a fiery mass of metal. He (Hippolytus?) (271) says that the moon, like the other heavenly bodies, is a fiery stone which has been snatched up by the rotation of the aether; that the moon receives its light from the sun; and that the moon is made of earth and has plains and gullies on it. He nowhere explains how all these statements are to be reconciled. Diogenes Laertius (340) reports that according to Anaxagoras the moon has habitations on it in addition to hills and gullies. Theodoretus (450) and Lydus (595) say that the moon is a fiery solid body which has on it plains and mountains and gullies. Stobaeus (484–487) repeats Plutarch's statements and explains why the mixture of murky and fiery substance received the name, mentioned also by Plutarch, "the body which shines with false light": since the moon has some high parts, some level parts, and some concave parts, the mixture of fiery and murky substance makes it seem shadowy, and this led people to call its light "false." Olympiodorus (607) holds that the moon has its own light in addition to the light it receives from the sun but that its own light has the color of glowing coals! Both Plutarch and Olympiodorus attempt to reconcile the tradition which includes the moon along with all the other heavenly bodies in the category of flaming stones with the tradition that the moon is made of earth and shines by reflected light. The former tradition arose, as we saw in the previous section, by generalizing from the sun to all the heavenly bodies. We have here a development which parallels that which took place in regard to the moon and planets from the time of Galileo up to the present day: the realization that these heavenly bodies are composed of the same substance as the earth led to speculation that they are similar to the earth in all their features, and have on them mountains, valleys, plains, and possibly even life. It was natural to ascribe these speculations to the one who first held the celestial bodies to be terrestrial in composition.

k) The nature of thunder and lightning. According to Aristotle (40) Anaxagoras believed that thunder and lightning occur when flaming aether falls from its natural place above the clouds and is extinguished in them. Seneca (135) tells that the falling aether is trapped in the clouds for a long time. Plutarch (175), Galen (231), and Stobaeus (490) present a different explanation: when aether falls into the air the noise is heard as thunder, and the contrast of the color of the fire with the black of the clouds appears as lightning. In addition, they expand the theory and ascribe to Anaxagoras the view that falling aether accounts for additional storm phenomena, such as hurricanes and typhoons. Origen(Hippolytus?) (271) gives in the name of Anaxagoras only the simple statement that thunder and lightning come about when heat falls into the clouds. Alexander (293) in his commentary explains at length the statement of Aristotle (40). Diogenes Laertius (340) gives a completely different account which has clearly confused Anaxagoras with others; he says that thunder is the collision of clouds, and lightning what is ejected from between the clouds when they collide.

A generalization of Anaxagoras' theory of thunder and lightning first appears in Plutarch (174) where Anaxagoras' mechanism of falling aether is called upon to account for shooting stars, which are taken to be sparks that fall down from the aether and are immediately extinguished in the cold regions below. (Thus in a sense a shooting star is a very minute flash of lightning.) This ingenious theory is repeated by Galen (230) and by Stobaeus (489). Origen(Hippolytus?) (271) introduces the fantastic theory that shooting stars are sparks which fly off from the heavens as they move. Diogenes Laertius (340) confuses Anaxagoras with the Peripatetic school, saying that according to Anaxagoras shooting stars are shaken out of the air like sparks.

l) On the inclination of the ecliptic. Plato (9) tells us only that Anaxagoras dealt with angles of inclination of the earth. The next mention of the topic appears in Plutarch (165) where we are told that, according to Anaxagoras, after the act of creation was completed the cosmos somehow automatically inclined towards its southern part. Galen (221), Eusebius (380) and Stobaeus (478) all repeat this statement. Diogenes Laertius (340) makes the account more vivid by describing in detail how the heavens appeared before the inclination took place.

The passage in Plutarch suggests that he knew nothing more about Anaxagoras' statement concerning the inclination of the earth than can be found in Plato. The mechanism of the inclination is ascribed by Plutarch either to Mind, or not to Mind! He adds to the information in Plato only the idea that at one time the heavens were not inclined and that the inclination was part of the original act of ordering the cosmos. This statement too probably has its root in Plato, who speaks of angles (plural) of inclination of the earth, intimating that there was more than one angle, and that the discussion therefore concerned a variation in angle from a different state to the present one. Plutarch tells that Anaxagoras held that the inclination of the ecliptic occurred at the very end of the creation, after animals were formed.

All of the above traditions have their origins in writings from the time of Plato and Aristotle. In each case it is possible to trace the changes an original statement has undergone during the succeeding centuries. Except for a few cases of obvious confusion or misinformation, most of the changes made are reasonable and in the established pattern of scholarship. In most cases they are expansions which consist of explanations and generalizations not incompatible with Anaxagoras' theories.

3. Traditions Constructed from Allusions or Misreadings or from Historical Probability

Here we shall consider traditions about Anaxagoras which are not repetitions or expansions of explicit accounts given in the earlier sources, but instead are reconstructions based either on hints in earlier sources or on general historical information about the times and circumstances in which Anaxagoras lived. Their degree of authenticity can be determined since their origins are known, and it can be seen at a glance what transformations they underwent. The following are some typical examples of such traditions:

a) Anaxagoras was a pupil of Anaximenes, and transferred the Ionian school of philosophy from Ionia to Athens. Cicero (108) is the first to tell us that Anaxagoras was a pupil of Anaximenes. Strabo (121) and Galen (216) repeat this, and the latter adds specifically that Anaxagoras came to Athens from Miletus, the home of the Ionian school. Clement of Alexandria (251) names Anaxagoras as the next head of this school of philosophy after Anaximenes and tells that he transferred the school from Ionia to Athens. Diogenes Laertius (337, 340) also places Anaxagoras in the line of the heads of the school at Miletus, as Anaximenes' student and immediate successor. Eusebius (369) and Augustine (434) simply mention that Anaxagoras was Anaximenes' pupil. Theodoretus (457) gives the by now traditional order of succession of the Ionian school, but adds the novel element that each philosopher was opposed to the theories of his teacher! Simplicius (619) tells that Anaxagoras shared the philosophical views of Anaximenes.

Histories of philosophy generally try to trace the genealogy of philosophical doctrines. The ancient historians of philosophy, however, had at their disposal fewer names than, for example, the modern historian writing about the last two centuries. Anaximenes and Anaxagoras came from cities of Ionia, and had some physical theories in common (see, for example, source 29). Furthermore, Anaximenes lived before Anaxagoras, and no name of an Ionian philosopher between them was known. These facts immediately suggested a link between the two, and the uncertainty in the chronology of both Anaxagoras and Anaximenes made it possible to assume that they were related as teacher and pupil. (See Part I, Chapter 1, Note 2.) We have no way of knowing whether this assumption is valid or not.

b) Anaxagoras was nicknamed "Mind." The statement of Timon of Phlius quoted in Diogenes Laertius (340) is probably the source of the repetitions of the statement that Anaxagoras was nicknamed "Mind." Since Timon lived over a century after Anaxagoras, and wrote his *Silli* in order to ridicule the dogmas of all early philosophers who were not skeptics, there is no reason to assume that this is anything more than a satirical nickname given to Anaxagoras by Timon. The name, however, was clever and appropriate, and stuck to Anaxagoras.

c) Socrates was Anaxagoras' pupil. The account of Plato (3) is the obvious source of the confusion which occurs in Diogenes Laertius (342, 344), who makes Socrates the pupil of Anaxagoras; these two statements in Diogenes directly contradict other statements made by him (337, 341) where Socrates is removed from Anaxagoras by a generation. Aelius Aristides (209) says that Socrates discoursed with Anaxagoras. (Sic!) Theodoretus (447) also refers to Socrates as Anaxagoras' pupil.

d) Euripides was a pupil of Anaxagoras. According to Satyrus (95, 96), Euripides admired Anaxagoras greatly, and presented a short summary of Anaxagoras' cosmogony in one of his plays. Cicero (106) tells us that Euripides was a pupil of Anaxagoras. Diodorus of Sicily (115) repeats this, and adds that Euripides agreed with Anaxagoras' theories concerning the nature of the universe. Dionysius of Halicarnassus (119, 120) is more specific and tells us that Euripides actually went to the school of Anaxagoras, and that he used the doctrines of Anaxagoras in his plays, especially in the *Melanippe*, which is quoted in this connection by both Diodorus and Dionysius. Vitruvius (124), after noting that Euripides studied with Anaxagoras, goes on to describe at length the physical theories which Euripides held. Aulus Gellius (204) quotes Alexander of Aetolia, a contemporary of Satyrus, as calling Euripides the nurseling of noble Anaxagoras. Diogenes Laertius (340, 344) brings as proof that Euripides studied with Anaxagoras the statement of Euripides in the *Phaethon* that the sun is a golden clod of earth. Origen (269) is more careful, and ascribes the philosophical doctrines in Euripides' plays to Anaxagoras or to some other wise man. Eusebius (369) lists Euripides as one of the three important students of Anaxagoras.

From Euripides' plays there is no evidence that he adopted the doctrines of any one particular school of philosophy. Euripides and Anaxagoras were contemporaries, to be sure, and it is quite likely that Euripides did have contact with Anaxagoras; but we have no evidence that Euripides would have considered himself Anaxagoras' pupil. The whole subject has been discussed thoroughly by Decharme [32].

The tradition that Euripides was Anaxagoras' pupil gave rise to another tradition, concerning Anaxagoras' explanation for the rising of the Nile. We know from Aristotle (85) that Anaxagoras ascribed the annual inundations to the run-off of snows which melt in the spring; but we are also told there that Anaxagoras did not specify where he thought these snows lay (compare also Athenaeus, source 248). Thus we find Origen(Hippolytus?) (271) placing them in the north. But most of the later writers, under the influence of the tradition that Euripides was Anaxagoras' pupil, ascribed to Anaxagoras Euripides' statement (see source 248) that the snows lie in Ethiopia. Compare for this Diodorus Siculus (116, 117), Seneca (136), Plutarch (179), Galen (232), and Lydus (596).

e) Anaxagoras predicted the fall of the meteorite which fell at Aegospotami during his lifetime. Seneca (139) tells us that according to Charmander Anaxagoras saw in the heavens a huge unusual light which shone for many days. (Compare Aristotle *Meteorologica* 344b32ff.) Pliny (141) identifies this light as a comet (on the basis of Aristotle, *loc. cit.*), and adds that the Greeks would often tell how Anaxagoras had predicted the time at which a stone would fall from the sun, a prediction made possible by Anaxagoras' knowledge of heavenly signs. The stone is said to have fallen in the middle of the day, to have been the size of a wagon, and to have been still in existence and on display at the time of Pliny. Pliny goes on to tell of another meteorite which was exhibited at Abydus in his day, whose fall was also said to have been predicted by Anaxagoras. The date which Plutarch gives (196) for the fall of the stone at Aegospotami is well after Anaxagoras' death. He too tells that the stone was still exhibited in his day, but he does not say that Anaxagoras predicted the time of the fall. Instead, he reports the story that Anaxagoras had predicted that a stone would one day fall from the heavens when it was shaken out of place. Diogenes Laertius (340) tells only that it was a common story that Anaxagoras predicted the fall of the stone which occurred at Aegospotami. Philostratus (262) brings the prediction of the fall of the stone as yet another example in a long list of miraculous prophecies which Anaxagoras was said to have made. Philostratus makes no attempt to give a rational explanation for the prediction, e.g. he does not say that it was based on Anaxagoras' theory that there are stones in the heavens. Ammianus Marcellinus (397, 398) also mentions this prediction as an example of Anaxagoras' prophetic powers. Lydus (597) tells us that the stone fell around 464 B.C.E., and says that Anaxagoras predicted that a stone would fall from the sun, and that the fall was preceded by a portent. He adds that the stone still exists in his day, but he gives also a slightly conflicting account (which he refers to Apuleius) to the effect that this prediction of Anaxagoras was fulfilled near Abydus and that the stone is still there. Lydus does not consider these two accounts as separate, but says that only one stone fell and that he is not sure exactly where it is.

It seems likely that a large meteorite, or perhaps more than one, fell around the region of the Dardanelles sometime in the fifth century B.C.E. Whether this happened during Anaxagoras' lifetime or not is unknown. It is not difficult to understand how such an event could be connected by its observers with the physical theories of the only natural philosopher of prominence during that period who had claimed that there are objects made of stone in the heavens. It would then be a natural step to make the fall of a meteorite a vindication of Anaxagoras' theory, and further to hold that the theory contained in it the prediction that such events would occur. Whether Anaxagoras knew of the fall of large meteorites, and whether if he had heard of such things, he would have tried to incorporate it into his theory, cannot be decided.

It is a short step from Anaxagoras, the man whose theories encompass the possibility of stones falling from the sky, to Anaxagoras, the man who predicted the time of the fall of the stone at Aegospotami; and it is just another short step to Anaxagoras, the man who used heavenly signs as omens to predict this fall, and from there to Anaxagoras, the prophet, who predicted all sorts of occurrences which we shall now proceed to trace.

f) Anaxagoras the prophet. Origen(Hippolytus?) (271) says simply that Anaxagoras was called by many a prophet. Diogenes Laertius (340), after telling of Anaxagoras' prediction of the fall of the stone at Aegospotami, recounts how once Anaxagoras came to the Olympic games dressed in a skin as a protection against rain, and how it subsequently rained. Aelian (258) tells how all Greece recounted this story and adds that it was told of Hipparchus as well as of Anaxagoras! Philostratus (262) again treats the story as generally known, and adds two other stories of predictions which Anaxagoras was said to have made, that night would come out of day (an obvious reference to an eclipse), and that a house would fall. (Could this be a reference to an earthquake? See immediately below.) Both these predictions were said to have come true. In (265) Philostratus says that Anaxagoras predicted many celestial occurrences. Ammianus Marcellinus (398) adds to the Aegospotami story the story that Anaxagoras was able to predict earthquakes by examining mud from cisterns. (Perhaps this is due to Ammianus' account of earthquakes in source 396 [see also source 39] in which the mud clogging the pores of the earth plays an important role.)

In addition, Ammianus Marcellinus (398) relates that the knowledge which enabled Anaxagoras to predict falling stones and earthquakes was acquired by him in Egypt. Theodoretus (446) is more specific and tells that Anaxagoras was in Egypt and spoke there with the wise men of the Egyptians and of the Hebrews, learning from them all sorts of things about the world. Both these sources represent attempts by certain ancient scholars who, like their modern counterparts, try to trace all wisdom to Egypt.

g) Anaxagoras was a student of geometry. We find in Plutarch (157) the remarkable statement that Anaxagoras discovered a method for squaring the circle. Proclus (469) tells that Anaxagoras and Oenopides were the successors of Pythagoras in geometry. Both these statements are ultimately derived from Plato (9), as Proclus tells us explicitly. Since the boys there described were drawing circles in the air, it was assumed later that Anaxagoras must have studied geometry, and specifically the properties of circles; and we know that the outstanding problem in antiquity concerning the circle was the problem of squaring the circle.

h) The trial of Anaxagoras. The earliest versions of the story that Anaxagoras was put on trial are those brought by Diogenes Laertius (340) in the name of three historians of the third century B.C.E. Sotion is said to have written the following account: Cleon, the political enemy of Pericles, brought a charge of impiety against Anaxagoras because he had said that the sun was a red-hot mass of ore. Anaxagoras was defended by Pericles, fined five talents, and sent into exile. Satyrus is reported to have given the following account: the indictment was brought by Thucydides, the son of Melesias, as a political step against Pericles, and the charge was not only impiety but also treason in the Persian War. Anaxagoras was condemned to death, but he had already fled Athens when the verdict was passed. When told of the condemnation he said, "Nature has long since condemned both the Athenians and me." The third account is that of Hermippus, who did not relate the charges brought against Anaxagoras, but told that he was condemned to death, and that while he was being held in prison pending his execution, Pericles came out and asked the Athenians if they had any complaint concerning the conduct of his life. They said they did not, and he replied that he was Anaxagoras' pupil, and that he desired them to set Anaxagoras free. The Athenians acquiesced in this request, but Anaxagoras though free could not bear the shame, and put himself to death. Diogenes mentions yet a fourth account of the trial, given by Hieronymus of Rhodes, and brings from that account the story that during the trial Pericles led his sick teacher into court in such a debilitated state that he was acquitted more out of pity than out of justice.

All the earliest accounts thus date from the third century B.C.E., and they differ markedly from each other in their particulars. Later accounts also differ. Diodorus (118) tells of a charge of impiety in which Pericles too was implicated. Josephus (143) tells that Anaxagoras was acquitted by only a few votes when he was placed on trial by the Athenians on charges of impiety. Plutarch (149, 157, 195, 197) gives yet another account. He tells how the Athenians in Anaxagoras' day were opposed to atheistic scientific investigations and how Diopithes, aiming to attack Pericles through his teacher Anaxagoras, had a law passed to prosecute all those who did not believe in the gods and who taught about the heavenly bodies. Anaxagoras was sent to prison (where he managed to square the circle), but Pericles rescued him with difficulty, and, fearing for his life, sent him out of the city.

Diogenes Laertius (342, 343), in the *Life of Socrates*, states simply that Anaxagoras was condemned by the Athenians, and that when he was condemned he said, "Nature has condemned them"; this story is the same as that given by Diogenes in the name of Satyrus. In the *Life of Socrates* the same saying is brought in the name of Socrates (sic!), with the brief comment that some people ascribed it to Anaxagoras. Eusebius (372) tells us that Anaxagoras barely escaped being stoned to death by the Athenians on the grounds that he was an atheist, since he spoke not of the sun but of its Maker as a god. Augustine (435) records only that Anaxagoras was prosecuted because he said that the sun was a flaming stone, which was tantamount to denying God. Cyril of Alexandria (440) tells that Anaxagoras was tried in Athens and condemned to death because he said the sun is a fiery stone. Boethius (563), in a list of philosophers who were persecuted, mentions the exile of Anaxagoras, and Olympiodorus (603) tells that Anaxagoras was ostracized from Athens for having had the audacity to say that the sun is a red-hot mass of ore, but that he was later recalled due to the efforts of Pericles, who moved the people by his rhetoric.

No two accounts of the trial agree in their particulars. It is therefore clear that whatever the status of Anaxagoras' trial as historical fact, we know nothing whatsoever about its details.[1] The only thing on which all the accounts agree is that Anaxagoras was prosecuted for impiety. Indeed, from the diversity of the four earliest accounts, we can safely assume that the only solid basis on which their authors built was the bare statement that Anaxagoras had a trial. The remainder of these accounts can easily be understood as reconstructions based on historical probability. Assuming that there had been a trial, each of these historians had to find a plausible charge, to perceive a deeper motive behind the charge, and to reconstruct an account of the events that took place after the charge was brought. The fact that Anaxagoras was a natural philosopher who spoke of the sun as a red-hot mass of ore at a time when the sun was considered to be divine provided the historians with an obvious charge against him, the same charge of impiety brought against Socrates. Since Anaxagoras came from Clazomenae, which was under Persian rule during the war between Athens and Persia, collusion with Persia was also a charge the Athenians were likely to have brought against Anaxagoras. The fact that Anaxagoras' name was always linked with that of Pericles his pupil made Anaxagoras an obvious target for the attacks of Pericles' political foes, since those of them who were afraid of attacking Pericles in the open could have done so through his teacher. This provided a deeper motive for the attack on Anaxagoras, since political motives are generally considered by historians to be more fundamental than others. They could then picture the trial as taking place either before Anaxagoras left Athens, some thirty years before his death according to some, or else at the close of Anaxagoras' life, when Pericles was falling from power and more susceptible to attack. If the earlier time was chosen, Thucydides was the likely prosecutor, if the later time, Cleon. The outcome of the trial also depended upon the way it seemed to fit into the context of Anaxagoras' life: if it occured early in his life, it became the reason for an early exile; if late, then it might have resulted in exile, or death, or suicide, or exile and recall, or plain acquittal. Thus all the accounts are plausible reconstructions, and may well have been constructed according to accepted methods of historiography.

Where then did the common feature of all the accounts come from? Was Anaxagoras tried? In (1), Plato quotes Socrates as saying in defense of himself to the Athenians at his trial: "Do you think you are prosecuting Anaxagoras, my dear Meletus? Do you have such contempt for these people, and do you think them so illiterate they do not know that Anaxagoras of Clazomenae's books are full of such statements? But no, you say the young men learn these doctrines from me . . ." Later scholars, interested in exploiting every phrase of the early sources in order to extract historical information from them, found in the first question of the quote evidence that Anaxagoras too had been placed on trial! Socrates' question was read as an allusion to a historical event, rather than as an outraged protest at the absurdity of accusing *him* of corrupting the youth through doctrines everyone knew to be *Anaxagoras*' and not his. Of course there would have been no point in Socrates referring to Anaxagoras' *books* if Anaxagoras had in fact been tried earlier for hiding the doctrines at issue.

The trial of Anaxagoras is a persistent historical myth based on plausible reconstruction, which because of its spectacular nature in posing him as the earliest martyr of science, and as the forerunner of Socrates, has appeared in almost every biography of Anaxagoras written since the third century B.C.E.

i) The cosmic vortex: Aristotle (27) tells us that Anaxagoras held that the external force which brought earth to the center was similar to the force which can be observed acting in fluid vortices, where heavier material is carried to the center of the whirl. He then goes on to tell specifically that the force that Anaxagoras thought *keeps* the earth at the center was not the force of a vortex, but rather the force exerted by the air under the earth. Plato (3) also makes it clear that the picture of the earth resting motionless on air is incompatible with the picture of a cosmic vortex which constantly keeps the earth in the center by means of its rotation. Plutarch (166, 196) tells us that according to Anaxagoras the whirling aether snatched up stones from the earth, set them on fire, and turned them into stars, and that the stars are held fast in the heavens by the intensity of the aether's rotation, presumably by the same mechanism that kept these heavy bodies up during the initial period of cosmogony. Plutarch apparently sees no difficulty in postulating that the same rotational motion that brings heavy bodies to the center can keep heavy bodies up in the heavens. Galen (222) copies Plutarch's explanation in (166), as do Eusebius (379) and Stobaeus (482). Origen(Hippolytus?) (271) relates that the heavenly bodies were set in place by circular motion, and that the sun, the moon, and all the stars are fiery stones which have been lifted from the earth by the rotation of the aether. In addition, this same rotation presumably throws off sparks which appear as falling stars. The picture is not clear. Clement of Alexandria (253) merely mentions Anaxagoras' "foolish eddies" as typical examples of the mechanisms Anaxagoras used in his theory to replace Mind. Theodoretus (450) talks about the universe (sic!) rotating, and drawing up stones by the rotation into the heavens. Asclepius (593) tells us that Anaxagoras said the vortex alone holds up the heavens. Anaxagoras is here chosen as the most typical representative of the large group of physicists who in their theories employed vortices to hold up the heavens. Simplicius (679, 680) explains at length that Anaxagoras held that the vortex counterbalances the weight of the heavens and keeps the sky from falling down, and that the swift whirling of the aether is crucial to the earth's remaining stationary at the center of the universe. Elsewhere (633), Simplicius assigns to Anaxagoras some specific phrases concerning rotation (see p. 375 f. below).

The tradition concerning Anaxagoras' use of rotational motion is one of the most confused and contradictory of all traditions about his doctrines.

j) The theory of earthquakes: Aristotle (39) explains that earthquakes occur when some aether falls underneath the earth and gets trapped in the hollows of the earth. This aether shakes the earth in its attempt to rise through the pores of the earth, which are clogged with mud. Seneca (138) is at a loss to explain how heat, which should always rise upward, gets under the earth at all. Aristotle points out that the lack of an explanation for this odd behavior of aether vitiates Anaxagoras' theory, but Seneca finds his own way out: he says that the heat is formed under the earth as the result of the collision of clouds under the earth, which produces lightning; for there are clouds under the earth just as there are clouds above it. Seneca's "solution" involves a mechanism for producing lightning, which is certainly not Anaxagoras' but more likely taken from Aristotle. Plutarch (177) gives up the idea that heat gets under the earth at all, and introduces *air* (known to be under the earth in Anaxagoras' theory) which somehow slips under the crust of the earth and pushes upward. According to Origen(Hippolytus?) (271) earthquakes come about when air from above the earth *falls* into the air below the earth, although it is just as difficult to understand why *air* above the earth should fall below it as it is to understand why *aether* should. Alexander (292) explains Aristotle's account at length. Diogenes Laertius (340) simply reports that according to Anaxagoras earthquakes are caused when air sinks into the earth. This account is part of the textbook tradition, as is Ammianus Marcellinus' (396) ascription of earthquakes to winds which blow under the earth. Ammianus adds that during an earthquake, when all the winds are busy with the earthquake, no breeze is felt above the earth.

k) How the sex of offspring is determined. Aristotle (51) says that Anaxagoras held that the sperm of the father is the sole determinant of the sex of the offspring, and that the offspring will be male if the sperm comes from the right testis, and female if it comes from the left; he adds that male offspring develop in the right side of the womb of the mother, while females develop in the left. Plutarch (182) has his own version: a male results if the sperm from the right testis lands in the right side of the womb or from the left testis in the left side of the womb; but if sperm from the right lands in the left side, or sperm from the left lands in the right side, a female results. Origen(Hippolytus?) (271) does not make it clear whether the sperm alone determines the sex, but says simply that male offspring are formed when the sperm which comes from the right side sticks to the right side of the womb, and female when the opposite occurs. Diogenes Laertius (340) says only that males come from the right and females from the left, according to Anaxagoras. Censorinus (274) includes Anaxagoras in a list of people who say that the seed of the mother contributes something to the formation of offspring, and adds that according to Anaxagoras the father alone determines the sex, male offspring resulting when the semen is emitted from the right side, and female when it is emitted from the left. There is no mention of the side of the womb in which gestation takes place.

l) Seeds are borne down from the air. Aristotle (55) says that Anaxagoras held that the seeds of plants are carried through the air on their way to the earth in order that they may be irradiated by the light of the sun, and so receive from the sun the ability to sprout. Theophrastus (86, 93) takes this theory to be an example of theories of spontaneous generation, that is, of the generation of wild plants from something else than the seeds of parent plants. Theophrastus' interpretation is put in question by the evidence which he brings for this theory, namely, by Anaxagoras' words that the air contains seeds (i.e. particles) of all things. We know this statement to be generally true in Anaxagoras' theory, of air as well as of all other substances. If the second statement brought by Theophrastus (86), that Anaxagoras says that when these are swept down in rain they produce plants, is in fact a continuation of the preceding one, then Anaxagoras' entire assertion would indeed involve a discussion of spontaneous generation; but if we have here a conflation of two separate statements—one, the general statement that the air contains the seeds of all things, and the other the statement that when seeds of plants are swept down in rains they grow into plants—then Anaxagoras' assertion here has nothing to do with spontaneous generation. Varro (109) repeats the statement that Anaxagoras held that there are seeds in the air, and adds that these are not perceptible to our senses. Irenaeus (237) reports that Anaxagoras advanced the theory that animals come into being when seeds fall to earth from the sky. This is doubtless a combination of the tradition about plants with Anaxagoras' statement that plants are animals.

4. Traditions In Which Anaxagoras Is Confused With Others

In this section we shall consider some of the traditions of late origin which are easily identifiable as arising from confusion with other thinkers.

a) There are invisible heavenly bodies under the moon. Origen (Hippolytus?) (271) tells that Anaxagoras held that below the stars there are bodies invisible to us which revolve along with the sun and the moon, and that at times they can cause eclipses of the moon. Stobaeus (486) mentions this too. This statement clearly arises from confusion of Anaxagoras with Anaximenes, who was commonly considered to be Anaxagoras' teacher, and whose theory of eclipses was attributed to Anaxagoras too in these sources.

b) The soul is material. Aristotle (41) states that Anaxagoras did not clearly differentiate between life and Mind, and that in some respects they are the same in the theory. We also know (see Part I, Chapter 5) that Mind and life were both taken to be incorporeal. Tertullian (255) is the only one to understand Aristotle correctly. Others seem to have been misled by Aristotle (43) to confuse Anaxagoras with everyone else. Thus Plutarch (180), Theodoretus (456), and Stobaeus (492) distinguish life from Mind in Anaxagoras' theory and say that life is material and indeed, gaseous in nature. Simplicius (702) combines both traditions, and says that Anaxagoras said life is composed of both material and nonmaterial parts. Aristotle's statement that Anaxagoras sometimes does distinguish between soul and Mind might easily have led to the assertion that for Anaxagoras life was material, while Mind was incorporeal.

c) Other cases. In (138) Seneca ascribes a Peripatetic explanation for lightning to Anaxagoras. In (146) Probus completely confuses Anaxagoras with Anaxarchus. In (477) Stobaeus interchanges Anaxagoras and Leucippus, while Galen, when he is copying source (181) from Plutarch, changes the name of Anaxagoras to Anaximander. Both of these cases may well have been errors due to copyists.

5. Late Traditions whose Validity Is Uncertain

Some traditions make their first appearance hundreds of years after Anaxagoras. Our attitude towards them has been stated in Chapter 1 above. The degree of reliability of the late reports already examined in Sections 1 to 4, which can somehow be traced back to the earliest sources, shows that none of the traditions brought in this section can be considered trustworthy, even though some of them may have a kernel of truth. The following are some of the later traditions for which no early source is in evidence:

a) The size of the sun and the moon. Plutarch (169, 189) reports that Anaxagoras held that the sun is many times the size of the Peloponnesus, and that Anaxagoras probably said the moon is as large as the Peloponnesus. Galen (225) reports that Anaxagoras believed that the sun is the size of the earth, while Origen(Hippolytus?) (271), Eusebius (377), and Theodoretus (445, 453) repeat Plutarch's version in regard to the sun. Diogenes Laertius (340) also brings the statement that the sun is larger than the Peloponnesus in the name of Anaxagoras, but adds that there are those who say that Tantalus said this first.

b) Why the sea is salty. Plutarch (178) says that according to Anaxagoras much of the water in the marsh which originally covered the earth was evaporated by the sun, and that the rest remained salty and bitter. Galen's report in (236) is also probably related to this subject. Origen(Hippolytus?) (271) tells that the sea existed all along, and that the water in it became "the way it is" by being evaporated, and also because of the rivers which flow into it. What he means by "the way it is" is not clear (see Note *ad loc.*). Alexander (291) says that Anaxagoras held that often the earth tastes sharp, because natron is dug out of it, and that sea water is salty because it has been strained through the earth and has washed over the earth. (Compare Galen, source 236.) There is no mention of evaporation here. Eusebius (383) repeats Plutarch's statement. There seems to be no general agreement on what Anaxagoras said about why the sea is salty. Compare Aristotle *Meteorologica*, Book 2, Chapters 1–3.

c) The turning-points of the sun and moon. According to Plutarch (170), Anaxagoras said that the sun reaches the turning points in its course when it has compressed the air sufficiently to make the resistant air push it back. Plutarch refers specifically only to the northern turning-point. The account in Galen (226) is completely garbled and unintelligible. Origen (Hippolytus?) (271) tells that both the sun and the moon reach turning points in their courses when they are pushed back by the air, and that in addition the moon often turns when it can not bear the cold; this is an evident attempt to explain why the moon changes its course more frequently than the sun. The astronomy here is somewhat confused. Stobaeus (483) repeats the statement of Plutarch.

d) The origin of winds. Origen (Hippolytus?) (271) reports in the name of Anaxagoras the theory that winds occur when air which is thinned by the heat of the sun is carried off to the sky. Diogenes Laertius (340) says only that winds come about when the air is thinned out by the sun.

e) All the heavenly bodies move from east to west. This statement first appears in Anaxagoras' name in Plutarch (167) and is repeated in Galen (223), Eusebius (381), and Stobaeus (482).

f) Anaxagoras studied eclipses. Valerius Maximus (134) tells that Pericles learned enough from Anaxagoras about the courses of the sun and moon to allay the fear of the Athenian public when an eclipse was about to occur. Origen (Hippolytus?) (271) discusses Anaxagoras' theory of eclipses, combining Anaximenes' theory with the correct explanations, which were well known in antiquity. Philostratus (262) includes the ability to predict eclipses among the prophetic powers of Anaxagoras. (See Part I, Chapter 8.)

g) The nature of sleep and death. Plutarch (185) recounts that Anaxagoras said that sleep comes about when the bodily activity is fatigued, so that sleep is a function of the body and not of the soul; while death is the sundering of the soul from the body. Galen (234) repeats this entire, and in (256) repeats the part about sleep.

h) Anaxagoras and the death of his sons. Diogenes Laertius (340, 349) quoted Demetrius of Phalerum as saying that Anaxagoras buried his sons with his own hands, i.e. that his sons died in his lifetime.

Cicero (106) tells the story that Anaxagoras, when he heard of the death of his son, said "I knew he was mortal when I begot him."

Valerius Maximus (130) repeats the story with the quote embellished. Dio Chrysostom (144) tells the same story as Cicero. Plutarch (151, 154, 155) adds more details, telling that the news of the death of his son was brought to Anaxagoras while he was teaching, and that he only interrupted the lesson long enough to speak the memorable words; in (154) Plutarch quotes the story from Panaetius, the earliest one recorded to have told it. Galen (211) tells that Posidonius reacted to the death of his sons in the same way as Anaxagoras did. Diogenes (340) brings the quote but tells that it is attributed not only to Anaxagoras but also to Solon and Xenophon, although he feels that Demetrius of Phalerum's statement (see the preceding paragraph) supports the attribution to Anaxagoras. Jerome (432) attributes the saying to Anaxagoras and to Telamon, Simplicius (707) only to Anaxagoras. Although the report that Anaxagoras' sons died during his lifetime has a fairly early origin, the story of what he said when he heard of their death is ascribed to too many others to be at all trustworthy.

i) There are many late stories which occur once and have no echoes elsewhere. Some of these are the following: Plutarch (192) tells how Anaxagoras dissected a one-horned ram. Diogenes Laertius (340) reports a remark of Anaxagoras' upon seeing the Mausoleum. (See Note *ad loc.*) Tertullian (257) refers to a story, which he assumes was well known, that Anaxagoras refused to return a deposit. (See Note *ad loc.*) Diogenes Laertius (340, 350) tells that Anaxagoras refused to accept Democritus as a student, and that Democritus took his revenge by opposing his theories. Irenaeus (237) tells that Anaxagoras was called "the atheist" by his contemporaries. This nickname is an obvious outgrowth of the tradition concerning the trial. Diogenes Laertius (340) offers Eubulus as an alternate version of Anaxagoras' father's name. Gregory of Nazianzus (399) talks about a well known "leather strap" associated with Anaxagoras. Diogenes Laertius (340) reports in the name of Favorinus that Anaxagoras was one of the earliest literary critics of the Homeric poems. This report may well be an expansion based on Aristotle *Metaphysica* Book A, Chapter 4, dealing with precursors of Anaxagoras (see the commentators *ad loc.*). Almost all of the information about Anaxagoras found in Censorinus (274) appears nowhere else. Vitruvius (123) mentions a book by Anaxagoras on perspective. Origen(Hippolytus?) (271) brings in the name of Anaxagoras the statement that the source of rivers is rain and ground water. The statement in Athenaeus (247) that Anaxagoras said that "birds' milk" is the white of eggs is obscure (see Note *ad loc.*). Martianus Capella (433) ascribes to Anaxagoras a proof that the earth is flat.

Chapter Three

THE SO-CALLED FRAGMENTS

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1. Scholarly Opinion Concerning Quotations of Anaxagoras' Words

In many of the sources in Part II some proverb or doctrine is attributed to Anaxagoras or brought in his name. Most of these are introduced with some form of the verbs *legō* or *phēmi*, and all are meant to be more or less faithful renderings of what Anaxagoras really said.

In modern times some of these citations have been taken to be Anaxagoras' own words, and others have not. It has never been clear what criteria were used in distinguishing "genuine quotations," (usually called "fragments") from spurious ones. Indeed the selection of supposedly true quotations has varied from age to age and from scholar to scholar, as has the order in which they have been placed in the attempt to restore the order they supposedly occupied in Anaxagoras' book. It is no surprise, then, that the resulting collections of "fragments" reveal considerable differences. A comparative listing of the contents of the collections will serve to indicate how far we are from a consensus of scholarly opinion concerning the passages which survive from Anaxagoras' book, and the order in which he presented his thought:

Schaubach (43): fr. 1, Simplicius *In Phys.*,[1] 155.26–30; fr. 2, *ibid.*, 155.31–156.1; fr. 3, *ibid.*, 34.29–35.3; fr. 4, *ibid.*, 35.3–9; fr. 5, *ibid.*, 164.17–22; fr. 6, *ibid.*, 156.4–9; fr. 7, *ibid.*, 164.23–24; fr. 8, *ibid.*, 164.24–25 with the addition of 156.14–157.4; fr. 9, *ibid.*, 176.24–25; fr. 10, *ibid.*, 461.20–21; fr. 11, *ibid.*, 176.29 with the addition of 175.13–14; fr. 12, *ibid.*, 164.26–165.1; fr. 13, *ibid.*, 165.14–15; fr. 14, *ibid.*, 156.10–12; fr. 15, Simplicius *In De Caelo*[2] (Schaubach's reference does not appear in Heiberg's text nor have we succeeded in locating it elsewhere); fr. 16, *In Phys.*, 460.26–28; fr. 17, Diogenes Laertius, 2.6; fr. 18, *In Phys.*, 300.31–301.1; fr. 19, *ibid.*, 179.3–6; fr. 20, *ibid.*, 179.8–10; fr. 21, *ibid.*, 35.14–18; fr. 22, *ibid.*, 163.20–24; fr. 23, *ibid.*, 157.7–9; fr. 24, a reconstruction from the great number of ancient sources which tell that Anaxagoras called the sun a red-hot mass of ore; fr. 25, Sextus Empiricus, 7.90.

Schorn (95): fr. 1, *In Phys.*, 155.26–30; fr. 2, *ibid.*, 155.31–156.1; fr. 3, *ibid.*, 34.29–35.3; fr. 4, *ibid.*, 34.21–26; fr. 5, *ibid.*, 164.23–24; fr. 6, *ibid.*, 164.24–25 with the addition of 156.14–157.4; fr. 7, *ibid.*, 300.31–301.1; fr. 8, *ibid.*, 179.3–6; fr. 9, *ibid.*, 179.8–10 with the addition of 155.23; fr. 10, *ibid.*, 35:3–8; fr. 11, *ibid.*, 35.14–18; fr. 12, *ibid.*, 157.7–9; fr. 13, *ibid.*, 176.29 with the addition of 175.13–14; fr. 14, *ibid.*, 156.10–12; fr. 15, *ibid.*, 164.17–20, with the insertion of one phrase from 166.16; fr. 16, *ibid.*, 164.26–165.1; fr. 17, *ibid.*, 163.20–24.

Mullach (76) adopts Schorn's passages making various changes in wording throughout.

Ritter and Preller (87) make no attempt to assign any order to the fragments, nor does their arrangement suggest that the fragments are the chief source of our knowledge of Anaxagoras. They have placed passages from Simplicius along with excerpts from many other ancient sources, including Plato, Aristotle, Diogenes Laertius, Origen (Hippolytus?), and others, under the following headings: (1) Life; (2) Pursuits; (3) Physical Change; (4) The Mixture; (5) Mind; (6) The Factor Which Fashions All Things; (7) The Source of Motion and Change; (8) The Description of Mind; (9) The Creation of Various Parts of the Universe; (10) Astronomy; (11) A Comparison with Empedocles' Elements; (12) The Void; (13) Living Things; (14) Perception. The following passages are marked off as fragments: *In Phys.*, 163.20–24, which appears as the chief source under heading (3); *ibid.*, 155.26–30, 155.31–156.1, 156.2–4, 4–9, and 10–12, each marked off as a separate fragment and brought with the intervening context as the chief source under (4); under (8) as the chief source *ibid.*, 156.13–157.4, and as a minor source *ibid.*, 300.31–301.1; under (9) *ibid.*, 179.3–6 and 8–10 which appear in the main source; under (12), as a minor source, *ibid.*, 164.17–20; under (13), in a minor source as part of a longer quote from Simplicius, *ibid.*, 164.23–24, 35.1–3 and 3–8; under (14) Sextus Empiricus, 7.90. The numbers of Diels' fragments are given, along with Schaubach's numbers.

Burnet (15) orders his selection as follows: *In Phys.* 155.26–30, 155.31–156.1, 34.29–35.9, 35.14–18, 34.21–25, 164.23–24, 164.24–25 with the addition of 156.14–157.4, 300.31–301.1, 179.3–6, 179.8–10 with the addition of 155.23, 157.7–9, 176.29 with the addition of 175.13–14, 156.10–12, 164.17–20, 164.26–165.1, 163.20–24.

Diels-Kranz (37): fr. 1, *ibid.*, 155.26–30; fr. 2, *ibid.*, 155.31–156.1; fr. 3, *ibid.*, 164.17–20; fr. 4, *ibid.*, 34.29–35.9 with the addition of 34.21–26 with 156.8–9 inserted; fr. 5, *ibid.*, 156.10–12; fr. 6, *ibid.*, 164.26–165.1; fr. 7, *In De Caelo* 608.26; fr. 8, *In Phys.* 176.29 with the addition of 175.13–14; fr. 9, *ibid.*, 35.14–18; fr. 10, Elias of Crete *Commentarii in Gregorii Nazianzeni Orationes XIX* ed. A. Jahnius

(*Patrologiae Graecae*, ed. Migne, Vol. 36) 36.911; fr. 11, *In Phys.* 164.23–24; fr. 12, *ibid.*, 164.24–25 with the addition of 156.14–157.4; fr. 13, *ibid.*, 300.31–301.1; fr. 14, *ibid.*, 157.7–9; fr. 15, *ibid.*, 179.3–6; fr. 16, *ibid.*, 179.8–10 with the addition of 155.23; fr. 17, *ibid.*, 163.20–24; fr. 18, Plutarch *De Facie In Orbe Lunae* p. 929B; fr. 19, *Scholia in Homeri Iliadem VI, Townley Scholia II*, ed. E. Maass, on P 547; fr. 20, Galen *In Hippocratis De Aëre Aqua Locis* (ed. Chartier) VI 202; fr. 21, Sextus Empiricus 7.90; fr. 21a, *ibid.*, 7.140; fr. 21b, Plutarch *De Fortuna* 3 p. 98 F; fr. 22, Athenaeus *Epitome* B p. 57D.[3]

There have thus been two approaches to the problems of identifying fragments of Anaxagoras: one latitudinarian, and a second one somewhat stricter. Schorn, Mullach, and Burnet accept no passage as Anaxagoras' own which does not appear in Simplicius' commentary on Aristotle's *Physics*. Burnet states explicitly that all citations which do not come from this source are doubtful. Schaubach and Diels on the other hand are willing to accept passages not from Simplicius.

Among Schaubach's fragments not from Simplicius, fr. 15 and fr. 24 have never received any support; and fr. 17, the most common "quotation" from Anaxagoras in the ancient world, was omitted by Schorn, Mullach, and Diels-Kranz, rejected by Zevort (112) (p. 35, Note 1), and summarily dismissed by Burnet (p. 282, Note 37) as "not Anaxagoras' at all, but a summary of his doctrine, probably due to Theophrastus." Fr. 25, however, was accepted by Ritter and Preller, and by Diels-Kranz. Earlier Tennemann (100) (pp. 422, 424), commenting on the passages in Sextus Empiricus which seem to quote Anaxagoras, had rejected the one in 7.140 (Diotimus' statement that Anaxagoras said perception is the basis for knowledge of the unknown) because he found it to be incompatible with the other passage, Schaubach fr. 25 from Sextus 7.90 (the statement that according to Anaxagoras the senses are too weak to perceive details, but perceive only the predominant component in any object). Schaubach omitted the *former* passage, perhaps because he was swayed by Tennemann's argument. On the other hand, Schorn (p. 3) objects that the latter is not genuine, and disdains even to consider the former, as does Zevort (112) (p. 35, Note 1). On the other hand Diels-Kranz accepts both passages.

As for the fragments included first in the collection of Diels-Kranz, fr. 10 was found by Mathewson (70) (p. 69) to be of little value; Joehrens (61) points out in commenting on fr. 21b that it is not at all clear which words to assign to Anaxagoras and which to Plutarch (compare Note 2 to source 150); the controversy concerning fr. 20 can be followed in Diller (38) and in Kraus *et al.* (63), both of whom hold that the doctrines stated by Galen in that passage belong not to Anaxagoras but to Hesiod, a view adopted by Joehrens also; fr. 21 derives from a long, late tradition about Anaxagoras and other presocratics, and there is no reason to assume that Sextus, who often repeats the same words without referring them to Anaxagoras, meant them to be a direct quotation here; fr. 10 was chosen because the Scholiast on Gregory introduced it with the word *phēsi*, but *phēsi* is used so often for rough paraphrase in our sources that it is surprising that its appearance in such a late source should have occasioned any interest at all.

These few instances are representative of the controversy which has surrounded the process of determining "true fragments" of Anaxagoras. Arguments concerning authenticity have been brought exclusively against those not found in Simplicius. Their status has been called into question so often that there is no need to discuss them further.

2. The "Direct Quotations from Anaxagoras' Book" Brought By Simplicius

The only passages which have gained almost universal and unquestioning acceptance as true quotations of Anaxagoras' words are those brought by Simplicius, which were rediscovered by Cudworth (30) in the seventeenth century. These form the bulk and core of all the collections. They alone claim consideration as genuine quotations, and it is to them we must look if we hope to know with any confidence what remains, if anything, of Anaxagoras' book.

Simplicius' citations, however, are far from *ipsissima verba.* At best they are paraphrases, whose usefulness and reliability has been greatly impaired by numerous insertions, expansions, and gaps, and by various other ravages of time and tradition. At worst they represent perhaps the attempt of some ancient scholar, using earlier sources and textbook accounts, to reconstruct Anaxagoras' words. The fact is that with very few exceptions *we cannot trace the words of Simplicius' quotations from Anaxagoras farther back than the time of Simplicius, in the sixth century* C.E. Our imaginations are therefore free to wander and to imagine the worst actually occurring, *unless it can be proved that these late passages go back to early sources.* Since in fact the quotations from Anaxagoras to be found in Simplicius' commentaries have no real claim to authenticity, they are useless as sources from which to reconstruct Anaxagoras' thought. We will now present detailed evidence for these assertions.

A. *The Same "Quotations" Appear Differently in Different Places*

Each time a quotation is brought by Simplicius, it differs somewhat from its previous appearances. A detailed word by word comparison of Simplicius' different citations of Anaxagoras, never before presented, reveals numerous divergences:

The passage at *In Phys.* 27.10–11 recurs at 165.3 with the article *ta* inserted between *hotōi* and *pleista.*

The passage *ibid.* 27.9–10 recurs at 156.16–17 with the word *gar* inserted after *panti,* with the *ny*-movable on *enestin,* and with the addition of the words *hōsper en tois prosthen moi lelektai* after it; and when it appears again *ibid.* 164.23 and 172.4 the words *plēn nou* are attached to it.

Ibid. 34.20 has *homou panta chrēmata ēn* as does 164.15, and 172.2; the order *homou chrēmata panta ēn* occurs *ibid.* 155.26, and at *In De Caelo* 608.21 where the form *mikrotēta* takes the place of *smikrotēta;* at *In Phys.* 163.8 and 460.2 the words appear in the order *ēn homou panta chrēmata.*

When the passage extending from *ibid.* 34.21–26 reappears at 156.4–9, the last sentence beginning *toutōn de houtōs echontōn,* which Simplicius may or may not have intended to be part of the quote, is replaced by the words *oude gar tōn allōn ouden eoiken to heteron tōi heterōi,* and in addition the word *hapantōn* of 34.22 appears in line 156.5 as *pantōn,* and *te* is inserted in 156.6 between *tou* and *dierou,* which follow uninterrupted upon one another in 34.22–23.

When *ibid.* 35.1–3 reappears at 157.9–11 the words *hen einai,* which all the manuscripts have at 35.1 (although Diels did not follow them), appear as *eneinai* in 157.9.

The first line of the passage *ibid.* 35.3–9 recurs at 157.11–12 with the substitution of *ge* for *te;* the reappearance of *ibid.* 35.4–8 at 157.12–16 shows *synēmmenas* for *synōikēmenas, hēlion* for *ēelion,* and *autois eneinai* for *autoisin einai.*

The passage *ibid.* 34.29 ff. appears once again in *In De Caelo* 609.6 ff., but there at 609.8 the words *chroias kai hēdonas* of *In Phys.* 35.1 appear in reverse order as *hēdonas kai chroias;* the enclitic word *te* after *anthrōpous ibid.* 35.1 is omitted at *In De Caelo* 609.8; again *ibid.* 609.10 *hēlion* appears, as in *In Phys.* 157.15, for *ēelion;* and the words *te autoisin einai* found *ibid.* 35.5 are missing at *In De Caelo* 609.10, which does not show the *autois eneinai* of *In Phys.* 157.13–14 either.

The singular form *lithos* and its verb *sympēgnytai* of *ibid.* 155.22-23 appear in the plural as *lithoi* and *sympēgnyntai ibid.* 179.10.

When *ibid.* 156.13–14 reappears at 164.24–25 the word *chrēmati* with which the phrase ends is omitted; and *ibid.* 176.33–4 the next phrase appears as *monon auto ep' eōutou* instead of as *monos autos eph' heautou,* the form found *ibid.* 156.14–15.

Again, when *ibid.* 156.19–26 is brought *ibid.* 176.34–177.6 the word *ge* which occurs in 156.20 and 21, after *gnōmēn* and *hosa* respectively, is omitted in both the parallel places, *ibid.* 177.1 and 2; lines 156.22–24 (from *hōste perichōrēsai* to *perichōrēsei epi pleon*) are left out *ibid.* 177.3; the words *apokrinomena* and *diakrinomena ibid.* 156.24–25 are transposed *ibid.* 177.4; and the phrase *kai hosa nyn esti ibid.* 156.26 is replaced *ibid.* 177.5 by *hassa nyn mē esti.* (Note, however, that Diels-Kranz fr. 12 conflates both phrases in order to "reconstitute" Anaxagoras' *ipsissima verba.*) The passage *ibid.* 156.24–26 reappears elsewhere as well. When it appears *ibid.* 165.31–166.1 the article *ta* appears before *apokrinomena* in 165.32, the form *hoposa* in 165.33 replaces the *hosa* of 156.26, and the word *hopoia* found at 156.26 is omitted at 165.33; when it reappears *ibid.* 174.7–9 the words *apokrinomena* and *diakrinomena* are again in the reverse order of *ibid.* 177.4, and the word *mē* is again, as in 177.5, inserted between *nyn* and *esti,* though *hosa* agrees with *ibid.* 156.26; and the words *kai apokrinomena* are omitted entirely at line 30 in *In De Caelo* 608.29–31.

The passage at *In Phys.* 156.58–157.1 recurs in three places: at 174.22–24, at 176.21–23, and at 178.34–179.3. The word *te* occurs after *apo* in the phrase *apo te tou araiou* at the first and fourth occurrences of the passage but not at the second and third. At all occurrences except the fourth, however, the phrase *apo tou thermou to psychron* appears as *apo tou psychrou to thermon.*

When one phrase from *ibid.* 157.1–2 reappears at 175.11–12 the word *ouden* appears as *oude,* the last words *plēn nou* are left out, and the order of the verbs *apokrinetai* and *diakrinetai* is reversed; the same thing happens *ibid.* 176.24–25, so that it is not at all clear that the latter two passages are intended to be a repetition of part of the first rather than a separate quotation altogether. A similar case seems to occur *ibid.* 165.14 and 172.18 where what seems to be a repetition of *ibid.* 157.3–4 appears with a different meaning.

Such variations in readings, though often minor, can not be ignored. Many of them are doubtless due to careless oversights on the part of copyists, and on the part of Simplicius. One thing however is clear: *we do not have carefully worded direct quotations from Anaxagoras in the text of Simplicius, and any claim for one reading over another is entirely arbitrary.*

B. It Is Often Impossible to Tell Where the "Quotations" Begin or End

We often can not be sure where a quotation ends, and it is even sometimes difficult to tell where one begins.

Thus, for example, Gomperz (quoted in Diels-Kranz) believes that the words *ap' archēs* are part of the quotation *ibid.* 155.26–30. Others have begun the quotation with the words *homou panta.*

In *ibid.* 34.21 f. it is difficult to tell whether the sentence beginning *toutōn de houtōs echontōn* is supposed to be from Anaxagoras; it was omitted by Schaubach and by Burnet, but included by Schorn and by Diels-Kranz, probably because a similar passage seems to be quoted by Simplicius as Anaxagoras' at *In De Caelo* 608.24, and because in *In Phys.* 34.26–27 Simplicius seems to be explaining the meaning of the word *sympan* as if it were rare and difficult for his readers. One can not however assign this sentence to Anaxagoras with any assurance.

The sentence *ibid.* 35.8–9 also may not be a true part of the quotation which precedes. The Ionic words in it show that Simplicius considered it part of his quotation, but it may well have been added by one of his predecessors (see *D* below). It is omitted when this quote appears again *ibid.* 157.12–16. A similar thing may have happened with the first six words of this quotation *ibid.* 34.29–35.1, *toutōn de houtōs echontōn chrē dokein,* which Simplicius also believes to be from Anaxagoras. They may however be an expansion of the quote after *ibid.* 34.25–26, inserted to avoid the abruptness of a quotation beginning with the infinitive *eneinai,* a form of this quotation whose existence may be attested by the way it appears *ibid.* 157.9. On the other hand, it is even possible that *ibid.* 35.8–9 and 34.29–35.1 are separate quotations. Schorn omitted the former, as did Burnet, while Schaubach includes both, as does Diels-Kranz.

The passage *ibid.* 34.21–25/26 reappears at 156.4–9 with a different final sentence, accepted as genuine by Schaubach, Schorn, Burnet, and Diels-Kranz. Cornford (28) expresses doubts about the authenticity of this passage (p. 28, Note 3): "It is possible that it does not belong to Anaxagoras, but to Simplicius . . . To a Platonist *ta alla* is a familiar term for what is contrasted with 'the One' (whether the One be identified with *Nous* or with the *Migma*)."

Another passage which presents great difficulty begins at *ibid.* 163.20. Schaubach, Schorn, Burnet, and Diels-Kranz agree in taking it to line 24, but the last sentence of the section as they mark it off: *kai houtōs an orthōs kaloien to te ginesthai symmisgesthai kai to apollysthai diakrinesthai,* seems inconsistent with Anaxagoras' theory, where both phases of physical change, the creation of a given state as well as its destruction, result from *both* the coalescence *and* the dissociation of elementary particles. This sentence looks like a typical explanation of a commentator, repeating the technical terms used in the passage which is explained.

Schaubach is alone in taking the quotation *ibid.* 164.17 as far as

164.22, thus including the sentence beginning *ei gar pan en panti* and ending with *heautou meizonos,* and even turning it into the Ionic dialect. Though no one since has taken the quotation to extend beyond line 20, it is extremely difficult to tell where it begins or ends. If *hoti* introduces the quotation here, the quotation should be taken to start on line 16 with the words *oute to elachiston.* If, on the other hand, the words from *oute to elachiston* to *oute to megiston* are omitted, then the *gar* in line 17 must also be excluded from the fragment, although only Schorn and Mullach have done this.

The quotation from Anaxagoras *ibid.* 165.14–15 is so closely amalgamated with its surroundings that it is impossible to know whether to take it up to *ontōn,* as did Schaubach, who considered it a separate fragment, or to follow Schorn, Burnet, and Diels-Kranz in stopping short at *oudeni* and taking the passage to be a truncated quotation from the longer section *ibid.* 156.14–157.4.

Diels, in his text of *ibid.* 166.15–16 marks off the passage from *oute tou smikrou* to *elasson aei* as a quotation from Anaxagoras. That it should not be so marked is likely, since Simplicius goes on to add *oute to megiston* and then to mark it as a paraphrase with the words *hōs kai autē hē lexis tou Anaxagorou dēloi.* If one considers that Simplicius meant this passage to be a direct quotation from Anaxagoras then it ought at least to be continued to include *oute to megiston,* which is what Schorn did when he inserted these three words into the passage as it appears *ibid.* 164.17–20. It is more probable that Simplicius thought of the entire passage as merely a reminiscence of Anaxagoras' words.

Again *ibid.* 175.11–12: *oude diakrinetai oude apokrinetai heteron apo tou heterou* seem to be considered Anaxagoras' words by Simplicius, but they are followed directly by *dia to panta en pasin einai* so that the two phrases form a single unit. When *ibid.* 157.1-2 (where Mind is the subject under discussion) and 176.24 (where the quotation clearly stops after *apo tou heterou*) are compared, it seems entirely possible that 175.11–12 was really thought of as a separate quotation. The only alternative is that here too Simplicius was not quoting directly but simply bringing a reminiscence of Anaxagoras' words, introduced as in 166.15–16 with the formula *eipontos tou Anaxagorou.*

Another quotation whose beginning is difficult to ascertain is *ibid.* 179.8 where Schaubach included the words *houtō gar* while Diels-Kranz, with whom our translation agrees, considers them to be Simplicius'.

An especially clear example of Simplicius' method of connecting his own comments directly on to a passage he has quoted from Anaxagoras can be found in *In De Caelo* 609.11, where, in a passage which corresponds roughly to *In Phys.* 34.29 ff., the last sentence, ending with the words *kai ta alla hōsper par'hēmin*, continues straight on into the next sentence: *kai tauta ktl.* Although in this case the language of the added sentence is clearly different from that of the quotation, in other places it is not; and the way the quotation is blended into its surrounding context here should serve as a warning that in places where Simplicius' own words cannot be distinguished with complete sureness from those of the author he is quoting, no clear line can be drawn between the two, unless we have a copy of the text being quoted. Thus, for example, *ibid.* 172.13–14, Aristotle's words *kechōrismena ap' allēlōn . . . ouden hētton* are so intertwined with Simplicius' comments that we could not separate them without the help of the received text of Aristotle's *Physics*, and even with this text we cannot always be sure that Simplicius' copy of Aristotle did not contain a different reading. It is therefore often difficult and sometimes impossible to determine the extent of Simplicius' quotes of Anaxagoras, because they are not clearly differentiated from the context in which they appear. Here too we find that certainty about the *ipsissima verba* of Anaxagoras can not be attained.

C. The "Quotations" Are Full of Interpolations

If Simplicius' comments are difficult to disentangle from the beginning and end of the "fragments," how can we avoid the suspicion that he, or some predecessor, inserted his own comments into the body of any given passage ascribed to Anaxagoras? Indeed, the "quotations" are full of passages which strongly suggest interpolation. This is not surprising, since we know that, after the manner of most ancient commentators, Simplicius often interjects explanatory remarks in the midst of passages from Aristotle. There is no doubt that he has done the same in the course of interpreting the passages he "quotes" from Anaxagoras and that others before him had done the same. The "fragments" certainly all cry for explication.

Of the great many places where Simplicius interpolates quotations from Aristotle a few examples will suffice. *Ibid.* 163.13–14 Simplicius writes that Aristotle says (*legei*) *to ginesthai kai to apollysthai toionde kathestēken alloiousthai* whereas the passage from *Physics* 187a30 does not contain *kai to apollysthai* and the words are doubtless a gloss of Simplicius' to balance *to ginesthai*. In *In De Caelo* 590.12 Simplicius adds his own Platonist interpretation to a reminiscence of Aristotle *De Caelo* 301a12–13; omitting the verb and the particle *gar* where Aristotle writes *ex akinētōn gar archetai kosmopoiein*, Simplicius writes *ex akinētōn kai hēnōmenōn kosmopoiein*. Such interpolation is not limited to texts from Aristotle. Theophrastus is treated in the same way. For example, in quoting him at *In Phys.* 27.19 Simplicius makes the words *aitian mian* explicit by interpolating *ton noun,* while the same passage "quoted" from Theophrastus appears again *ibid.* 154.17 f. without these words.

Many passages of the so-called fragments of Anaxagoras appear to have suffered similar internal expansion. The second sentence of the passage *ibid.* 35.14–18 seems not to fit into the context; it is simply an explanation of the relationship between 'force' and 'speed,' necessitated by the absence of any further mention of force in the rest of the passage.

The last phrase of the passage *ibid.* 155.21–23 also looks like interpolation. It has no place in the cyclic process which is described in the passage; instead it is a comment expressing some reservations about the content of the lines before. The thought in it apparently is that stone precipitates out of water more often than it is formed through the compression of various types of soil. The added phrase, whose meaning is unclear, looks like a show of erudition and is irrelevant to the issue at hand; it is missing when the passage reappears *ibid.* 179.9–10.

The passage Simplicius says stood at the beginning of Anaxagoras' book (*ibid.* 15.26–30) seems full of interpolation. First, *kai gar to smikron apeiron ēn* is a comment very like *biēn de hē tachytēs poiei ibid.* 35.16: it is an attempt to relate the two words *apeiron* and *smikron,* whose compatibility in the previous sentence at first sight seems dubious; and its intention appears to be to explain to the puzzled reader that in the beginning things were infinite and small because there was an infinite number of small objects. This mistaken interpretation of Anaxagoras' words has been preserved for us from an earlier period as well in source 271, where, however, the words *kai tas smikroteras autōn apeira legei* were emended by Diels (Diels-Kranz vol. 2 p. 16) to read *kata tēn smikrotēta autōn* [*to*] *apeiron legōn.* Furthermore the last sentence of this "fragment" seems to be addressed to the reader who is puzzled over the meaning of the obscure verb *kateichen* (translated "surrounded" in source 623) used as the predicate for "infinite air and aether"; the verb is explained to mean that air and aether "were the most numerous and bulky constituents in the universe." The word *megista* makes it clear how air and aether could "surround" everything if they were infinite and everything else was infinite too. *Plēthei kai megethei* is the familiar phrase Aristotle uses in the form *kata plēthos ē kata megethos* in *Physics* 187b8; it is thrown in here despite the fact that it is not at all evident what it means to call air and aether "most numerous."

The last two words in *In Phys.* 156.1, *to plēthos*, seem on the face of it to be completely incongruous to the context, for how are we to understand the surrounding medium to be infinite *numerically?* The phrase can however be understood at once if we take it to be the addition of an interpolator who wished to explain that air and aether, which were said to be *numerically* infinite *ibid.* 155.29–30, could only be extracted from the surrounding medium if the surrounding medium itself were infinite numerically.

Ibid. 156.22–24 is missing when 156.19–26 is repeated at 176.34–177.6. The missing lines contain the absurd statement that the vortex will increase in intensity with time, a doctrine which can not be attributed to Anaxagoras, since we know that he believed in the existence of a cosmic churning only during the period of creation. The most likely explanation for the presence of these lines is that they were inserted unthinkingly in order to supply some details concerning the rotation mentioned *ibid.* 156.22; they may even have been anonymous lines deriving ultimately from some other natural philosopher.

We have already spoken above in *B* concerning the sentence *ibid.* 163.23–24 which is most probably the comment of Simplicius or of one of his predecessors on the criticism of common Greek usage found in the previous lines.

The words *estin hoisi de kai nous eni* which occur *ibid.* 164.23–24 may also be an expansion of an earlier quote. Here we probably have the base to which the addition was made *ibid.* 156.16–17, 27.9–10, and elsewhere. The phrase seems to have undergone a double expansion. What may have happened is the following: first some careful scholar wrote the words *plēn nou* after *en panti pantos moira enesti* in order to forestall misapprehension of Anaxagoras' meaning; and then someone else who knew that Anaxagoras believed Mind to be in all animals added *estin hoisi de kai nous eni.* The unexpanded core, *en panti ktl.*, is the only part of this passage which overlaps with *ibid.* 156.16–17, 27.9–10, etc., and it alone is necessary to the context in which Simplicius brings it here.

The phrase from *ibid.* 157.3 which reappears at 165.4 seems to have been expanded by Simplicius to read *heteron . . . ouden estin homoion oudeni heterōi apeirōn ontōn* instead of *heteron de ouden estin homoion oudeni.* At any rate only Schaubach among the fragment-collectors has not viewed the words *heterōi apeirōn ontōn* as an expansion.

Zafiropulo (109) (pp. 375–377), proceeding on his own assumptions, has chosen to condemn as spurious two other phrases: *amphōtera apeira onta ibid.* 155.23, and *gēs pollēs eneousēs* in 34.21, a phrase which Cleve (26) (p. 32, Note 3) and others also consider to be a side comment, possibly by Simplicius. Zafiropulo's reasons for suspecting these six words are not convincing, but nevertheless it is true that these phrases are no less doubtful than the rest of the *disjecta membra* of Simplicius' quotations of Anaxagoras.

It is well known that in cases where interpolations occur or are suspected, linguistic uniformity can not be used to argue for the assignment of words or phrases to the unexpanded core of the quotation. Simplicius, like all commentators, knows and uses the language of the works and selections he is discussing. (Compare, for example, the anticipation of the rare words *sympēgnysthai* and *apokrinesthai* of the quotations *ibid.* 179.8–10 in Simplicius' preceding comment in lines 7–8.) He certainly was capable of adopting the technical vocabulary of any author in his comments, and dialectal difference too surely posed no problem for him.

Many parts of the so-called fragments, then, may consist of interpolated comments, explanations, and expansions. In fact, it is virtually impossible to decide with certainty whether or not any given passage is an interpolation. Even if we were sure of the exact wording of a given quotation, and even if we knew where it begins and ends, still, because of the general practice of interpolating comments into texts, we would never be able to say with assurance that a particular phrase was part of the original quotation.[4]

D. The Presence or Absence of Ionic Forms is Not a Deciding Factor

Ionic forms sometimes appear in the text of a quotation from Anaxagoras. Their presence, however, seems to be arbitrary, because there is no consistency in dialectal form either from "fragment" to "fragment," or even within one purported quotation.

This has long been known. Schorn, for example, wrote on this point as follows (p. 7): "Cuius dialecti [*sc.* ionicae] ratio in singulis verbis perspici non facile potest; nam et pauciores numero reliquiae ipsae sunt et ionicae formae . . ."; then however he proceeds (pp. 7–8) to give a list of all the Ionic forms which remain and *to change all the other non-Ionic forms to Ionic* in his collection of the "fragments"!

The presence of an Ionic form can furnish no evidence for the authenticity of a particular passage, or even of a particular word. Schaubach, Schorn, and Mullach consistently converted into Ionic dialect every passage each of them chose as authentic. We can be sure that they were not the first to do so. Indeed at least one passage may have undergone this process at the hands of Simplicius. The first sentence of the long quotation about Mind *ibid.* 156.13–16 contains the Attic phrase *monos autos eph' heautou estin*; but in 176.33–34 the same phrase appears in Ionic (with an additional change of gender) as *monon auto ep' eōutou esti.*

The possibility of such wilful changes has not gone unnoticed in modern times. For example Cleve (26) (p. 32, Note 3), in speaking of a particular Ionic form, writes that it "cannot furnish a serviceable argument [*sc.* of authenticity] as there is something like a *petitio principii* involved. For the moment any one of the medieval copyists considered that remark traced to Anaxagoras himself, he had to change an original [*koinē*-Greek form] into [the corresponding Ionic one]." Of course, the medieval copyists were not the only ones who knew Ionic. Simplicius and his predecessors were no less capable of changing any passage they considered to be genuine into the Ionic dialect.

Dialect, then, can serve neither to authenticate nor to condemn as spurious any passage thought to be from Anaxagoras' book. Since this has been realized certainly since Schorn's time, it is strange that on the grounds of dialect alone, as it appears, quotations from Anaxagoras in the works of Plato and Aristotle, who certainly had Anaxagoras' book to copy from, have consistently been rejected by the collectors of fragments as spurious.

E. *It is Impossible to Establish Order Among Different "Quotations" or Among the Parts of a Single Long "Quotation"*

Many phrases from the purported quotations are found attached now to one passage, now to another. There is no way of knowing whether Simplicius meant each occurrence to represent a different passage in Anaxagoras' book, or, especially where there are no internal expansions but only extra words added at the beginning or at the end, whether he was just quoting what he pleased from a larger context. Furthermore, the longer "quotations" seem to have no coherence at all. They give the impression of being patchworks of shorter passages, loosely connected by topic. Portions of these longer passages too appear elsewhere in such a way that it is impossible to know whether they are independent short units, or sections drawn from the longer passages. Thus the order of the sentences Simplicius brings as "quotations" from Anaxagoras can not be determined at all.

The following account of the form each passage assumes in its various appearances will show how fluid, haphazard, and illogical is the sequence in which the different phrases and sentences purportedly from Anaxagoras appear.

The passage brought in *In Phys.* 27.9–12 reads *en panti pantos moira enesti kai hotōi pleista eni tauta endēlotata hen hekaston esti kai ēn.*

The words *hotōi to ēn* reappear once in the midst of the long "fragment" on Mind, *ibid.* 157.3–4, this time connected by *all'* to the phrase *heteron de ouden estin homoion oudeni,* and again, independently with *all'* prefixed, *ibid.* 165.3–4. The first part of the passage at 27.9–12, *en panti pantos moira enesti,* reappears three times: first at 156.16–17 in the long passage about Mind, where the words *hōsper en tois prosthen moi lelektai* are added; again *ibid.* 164.23 (where Simplicius comments that Anaxagoras says it often), with the addition of the words *plēn nou estin hoisi de kai nous eni*; and again at 172.4 with the addition of *plēn nou.*

The "quotation" *homou panta chrēmata ēn apeira kai plēthos kai smikrotēta* is found *ibid.* 34.20 and 164.15, as an independent unit, but *ibid.* 460.26 it stops short with the word *chrēmata; ibid.* 172.2–3 it continues with *kai gar to smikron apeiron ēn; ibid.* 155.26 it continues as at 172.2–3 and then are added the sentences beginning with *kai pantōn homou eontōn* and ending with *kai megethei*; the passage as thus constituted is brought as far as *hypo smikrotētos* in *In De Caelo* 608.21–23.

The passage beginning *prin de apokrithēnai* in *In Phys.*, 34.21, and continuing to *allēlois* in line 25 (or, according to Diels, to *panta chrēmata* in line 26) recurs *ibid.*, 156.4–8, where it can be (and has often been) taken to be connected to the preceding sentence in lines 2–4, and where it goes on after *allēlois* to add a different passage: *oude gar tōn allōn ouden eoike to heteron tōi heterōi.* In *In De Caelo*, 608.24, however, there appears independently, apparently as a "quote" from Anaxagoras, a little passage reminiscent of the sentence which follows *allēlois* at *In Phys.*, 34.25–26, namely the words *en sympanti chrē dokein eneinai panta chrēmata.*

Simplicius tells us *ibid.*, 34.28 f., that not far from the beginning of his first book Anaxagoras wrote the passage starting *toutōn de houtōs echontōn* and continuing apparently to *ouk an par' hēmin monon apokritheiē alla kai allēi.* This passage appears here as a consecutive group of sentences forming a single unit; but *ibid.*, 156.2, the same passage continues only up to *kai chroias kai hēdonas,* to which is added *prin de apokrithēnai ktl.* which we have spoken of above. The passage has lost its beginning and is introduced thus *ibid.* 157.9: *kai mentoi eipōn eneinai polla te kai pantoia ktl.* Simplicius then continues the quotation up to the words *hosa psychēn echei* and then goes on to say *epagei kai tois ge anthrōpoisin ktl.* (part of 34.29–35.8) continuing with the changes indicated in A above to *eis tēn oikēsin chrōntai.*

The passages spoken of in the last two paragraphs have all been united into one long fragment by Diels-Kranz, whose fr. 4 includes *ibid.*, 34.29–35.9, 34.21–25, 156.8–9, and 34.25–26. Fraenkel (45)

(p. 287, Note 1) takes strong objection to making one unit out of all these passages. He would divide the Diels-Kranz fragment into three parts, the first to include 34.29–35.9, the second to include 156.4–9, and the third to include 34.25–26. Fraenkel clearly calls into question the reliability of Simplicius' ordering in general when he argues that it is "pure conjecture" ("eine blosse Vermutung") to hold that 34.25–26 belongs directly after 34.21–25, where Simplicius has put it.

The passage *ibid.*, 155.21 recurs at 179.8 with an additional sentence prefixed to the section, and with the last sentence omitted.

The long passage about Mind begins *ibid.*, 156.13. When the first sentence there appears once again at 164.24–25, it is as an independent unit preceded by the words *ta men alla pantos moiran metechei*, and proceeding no further than the words *memiktai oudeni*. At 174.16 we read only the words *nous de estin apeiron kai autokrates* as an independent unit; while 176.32–34 repeats 156.13–15 as a "quotation" apart, though with a change of gender from masculine to neuter in the phrase *monos autos eph' heautou estin*. 301.5–6 is another self-contained passage which contains the same text as does 156.13–15, except that the introductory particle *de* ("and" or "but"?—we have translated it only at 164.24) is here replaced by *gar*.

The next section of the long "quote" on Mind at 156.15–16 appears nowhere else, nor does 156.16–19 reappear, except for the phrase *en panti pantos moira enesti*, discussed above. The section which begins at 156.19 is repeated alone at 176.34–177.6, though without the part of it extending from *hoste perichōrēsai tēn archēn* to *perichōrēsei epi pleon*, which occurs only at 156.22–24. Thus at 176.34–177.6 the two passages *esti gar leptotaton* to *nous ekratēsen* and *kai ta symmisgomena* to *diekosmēse nous*, separated in the long passage on Mind, are juxtaposed. The second of these passages in turn appears independently at 165.31–166.1 and again at 174.7–9, with the changes noted above in A. In *In De Caelo* 608.29–31 this passage, once again independent, loses its central portion; it is cut off in the middle after *egnō nous* and continues directly with *kai hopoia emellen esesthai kai hopoia ēn* and no more.

The next section of the long "quote" on Mind, 156.27–28, occurs nowhere else, but 156.28–157.1 reappears by itself four times: at 174.22–24, at 176.21–23, at 178.34–179.3, and at 181.3–6. Part of this passage again, lines 157.1–2, is to be found separately at 175.11–12 and at 176.24–25 with the differences noted above in A, and with the addition of the phrase *dia to panta en pasin einai* in the first of these places.

The final section of the long "quote" on Mind, 157.3–4, recurs independently at 165.14 and at 172.18, though 157.2–3 is not repeated.

We have already noted above that the last sentence at 157.4 occurs independently at 27.10–11 and at 165.3–4 with various small changes.

The passage *ibid.*, 163.6–7 is expanded by the addition of one sentence at the beginning and one at the end when it recurs at 163.20–24.

Ibid., 166.15–16, a place where Simplicius clearly did not mean to quote Anaxagoras directly, only the first few words, up to *elasson aei*, of the passage at 164.17–20 are found; all the rest is omitted.

The passages *ibid.*, 175.12–14, and 176.29 each contain the words *oude apokekoptai pelekei* in a different context. These two passages have been amalgamated into one "quotation" running consecutively from *ou kechōristai* to *apo tou thermou*. It is quite possible, however, that Simplicius added the words *hōs en allois phēsin* in 176.30 to indicate that he thought the two passages to be separate quotes rather than one and the same excerpt.

These examples indicate some of the difficulties involved in reconstructing from Simplicius' "quotations" of Anaxagoras a clear and coherent text of any appreciable length. Indeed, we can hardly point anywhere to a sequence of more than fifteen or twenty words that might with confidence be said to belong together; and we have no sure way of fitting together passages which occur now separately and now conjoined, or of determining the order in which they appeared in Anaxagoras' book.

F. Simplicius Did Not Have Anaxagoras' Book

The authenticity of the "fragments" in Simplicius is cast into even greater doubt by the fact that Simplicius did not have Anaxagoras' book. Indeed Anaxagoras' book was most probably lost before the end of the third century B.C.E.

Pliny the Elder, who seems to have obtained and made use of every book he could find bearing on the subjects he treats in his *Natural History*, never quotes Anaxagoras. Pliny prefixed to each part of his book a list of all of his sources, but Anaxagoras' writings do not appear as sources even for those parts dealing with subjects Anaxagoras treated. We can only conclude that Pliny was unable to obtain a copy of Anaxagoras' work in the first century C.E.

Nor does it seem that Diogenes Laertius had Anaxagoras' book to draw upon. Diogenes is fond of giving complete catalogues of the writings of the philosophers whose biographies he writes, but he does not even know the title of Anaxagoras' book, and he quotes only its "first sentence," in a form exceedingly common in antiquity and perhaps correct though rejected by modern scholarship as a traditional formula epitomizing Anaxagoras' fundamental doctrines. Diogenes too certainly did not have Anaxagoras' book.

Simplicius himself is silent about the existence of Anaxagoras' book in his time, although if extant it must have been exceedingly rare and difficult to obtain. If Simplicius had had Anaxagoras' book he might have been expected to remark on its rarity, since in the case of Parmenides' poem he cites "the rarity of the work of Parmenides" (*In Phys.* 144.26–29) as one of the factors which led him to quote from it at great length. In fact, however, Simplicius nowhere hints that Anaxagoras' book existed in his day. This immediately leads one to suspect that Simplicius did not have the book, but was quoting from an earlier collection of excerpts.

Indeed many modern scholars who have dealt with Simplicius' quotations of Anaxagoras have felt something strange about his collection. Brandis (2) (p. 238) expresses himself guardedly on the subject, limiting himself to the observation that Simplicius may well have had only fragments of the first book of Anaxagoras before him. Alexi (1) writes with circumspection, "Simplicius hatte bestimmt wenigstens einen Theil jenes Werkes vor sich." Burnet (15) feels that it is especially unfortunate that though Simplicius had the entire volume, which contained several books (sic!), before him, he quoted only from Book I. Finally, Cornford (28) (p. 83) accepts as axiomatic that Simplicius had Anaxagoras' books, so that when he is forced to admit that Simplicius cannot give a clear and unambiguous statement of Anaxagoras' theory of homoeomeries he takes it as proof that Anaxagoras' book was obscure. In general Simplicius' quotes have been held to be arbitrary and unclear, and to be limited to a very few aspects of Anaxagoras' thought.

However, Simplicius' partial ignorance of Anaxagoras' work and thought is not the only testimony to his having been without Anaxagoras' book. He does not even know the title of the work he is supposed to be quoting from directly. In *In Phys.* 34.29 he calls Anaxagoras' book *Peri Physeos*, while *ibid.*, 155.21, he refers to it as *Ta Physika*. Neither of these is a true title: the first is a generic term for all books dealing with physical science and the second means nothing more than "a treatise on the physical world."

Moreover, Simplicius admits at several points that he does not know what Anaxagoras said on a given subject, or that he does not know *whether or not* Anaxagoras made a certain statement, an admission it would be well-nigh impossible for him to make had he possessed the book. He writes *ibid.*, 165.4–5, "*It seems* that Anaxagoras also says that Mind attempts to separate the components, but can not."

Here Simplicius is following Aristotle's testimony (source 17), but he obviously had no excerpt from Anaxagoras' book which he felt would corroborate Aristotle's statement. Again, *ibid.*, 176.17, on the same point, he writes "Anaxagoras did not say straight out, *as far as I know*, that Mind's aim is to separate the homoeomeries, but the task it sets itself cannot be accomplished."

The fact that Simplicius has only a limited repertory of 'quotations' each of which he uses over and over again, even when not directly relevant, to illustrate many different points, constitutes further evidence that he was missing the larger context of the excerpts he brings. In *In De Caelo* especially he lacks quotations which can shed light on the subject under discussion. He has no "fragment" he cares to use to corroborate Anaxagoras' theory concerning the void, none to substantiate Aristotle's statement that Anaxagoras used the word "aether" in the sense "heat," none to support Aristotle's account of the way Anaxagoras explained the fact that the earth does not move, and so forth.

Thus we see that Simplicius could not have been in possession of Anaxagoras' book and that he can only have taken his quotations from some earlier collection of excerpts. Such a collection would have been liable to all sorts of change and modification since the time it was first made. The poor state of the excerpts becomes, then, somewhat easier to understand.

G. *Some of the "Quotations" May Not Be Even Remotely Related To Anaxagoras' Words.*

Finally, it is impossible to know whether the "fragments" contain any words at all which derive ultimately from the pen of Anaxagoras himself. If ancient collectors of fragments were like modern ones they must often have been induced to assign to a known author anonymous quotations bearing on subjects known to have been treated by him. Thus *fragmenta adespota* (anonymous quotations) were liable to be assigned to Anaxagoras, just as today lines of tragic iambics quoted anonymously by some ancient author are liable to be assigned to Euripides, or to some other familiar writer of tragedy. Such standard scholarly procedure may thus have made it impossible for succeeding generations of scholars to distinguish between anonymous quotations and excerpts from Anaxagoras' book.

There are many factors which might have induced scholars in antiquity to attribute anonymous passages to Anaxagoras. Any anonymous passage dealing with infinite quantities might have been attributed to him, as might any one dealing with Mind. Any anonymous passage containing a compound of the verb *krinein*, for example *diakrinein*, *apokrinein*, or *synkrinein*, might have found its way into the group of fragments preserved under Anaxagoras' name. In this way it might be possible to conjecture that the obscure passage in *In Phys.* 35.3–8 was attached to Anaxagoras' name because of the occurrence in it of the verb *sympēgnymai*. Concerning that passage it should be remarked that its subject matter appears nowhere else in the tradition about Anaxagoras. It may well have been attached to his name by someone who noted the linguistic similarity to other quotations and thought that it might be referring to the moon, which, according to later tradition, Anaxagoras held to be inhabited just like the earth.

We have no alternative but to conclude that we can never be absolutely sure that any passage brought by Simplicius from his handbook of excerpts had not been included originally on no stronger grounds than scholarly conjecture, and we can be especially suspicious where the subject matter of a "fragment" is absent in any early, reliable source. The value of the fragments is thus no greater than the value of their context, a sixth-century composition one thousand years removed from the time of Anaxagoras.

3. How the Ancient Handbooks of "Quotations" Originated

It is not necessary to discuss *why* collections of quotations from Anaxagoras were made, since the process by which authors, especially philosophers and scientists, are excerpted for teaching purposes is still common today. Moreover, the loss of a full work after it has been excerpted or epitomized for quick reading is too well known from antiquity, and from medieval and early modern times as well, to require any further comment here. The questions we wish to consider are *when* the first collections of quotations from Anaxagoras were made, and *what principle* determined the choice of the passages selected. We shall see that it is likely that *the first such collection was made during the time of Aristotle and his immediate successors*, and that *the passages chosen for inclusion for the most part were those which could best serve to illustrate Aristotle's comments concerning Anaxagoras.*

A. *Illustrative Excerpts Are Quoted in the Works of Aristotle.*

All through the Aristotelian corpus quotations are brought from the works of Aristotle's predecessors. In particular, paraphrases and quotations of Anaxagoras can also be found.

In source 67 we find Anaxagoras paraphrased in the words (989b15–16): *einai memigmena panta plēn tou nou touton de amigē monon kai katharon.* In source 73 we come about as close as we can to a direct quote, in the words (1056b29–30): *homou panta chrēmata ēn apeira kai plēthei kai mikrotēti.* Again in source 75 the words (1069b21) *homou panta* are quoted from Anaxagoras.

These reminiscences of Anaxagoras' own words appear in modified form, turned into Ionic, and in some cases changed fundamentally in their wording but not in their meaning, in the extant collection of "quotations" from Anaxagoras in Simplicius' commentaries. The first part of the paraphrase at 989b15–16 appears at *In Phys.* 164.23, the second part of it appears *ibid.*, 164.25, and the last two appear *ibid.*, 155.26–27 and elsewhere. The passages in Simplicius, as we have seen above, can no more be taken as verbatim quotations of Anaxagoras than can the passages in the Aristotelian corpus. Nevertheless it seems that the passages appearing in Simplicius have their origin in the passages in the *Metaphysica* chosen to illustrate the points Aristotle makes. This is all the more probable because no other role can be assigned to the quotations as they appear in Simplicius, since they seem to fulfill no evident function in the context of Simplicius' argument.

B. Most of the "Quotations" Are Meant to Serve as Source Material to Illustrate Statements of Aristotle

Almost all the "quotations" brought by Simplicius are meant to illustrate some statement of Aristotle about Anaxagoras' theory. Some twenty passages in Aristotle can be identified as the statements to which virtually every one of the "fragments" found in Simplicius' commentaries owes its preservation.

Sources 73 and 75 contain the words *homou panta* quoted by Simplicius at *In Phys.* 34.20, 155.26, 163.8, 164.15, 460.2, and *In De Caelo* 608.21. Sources 44, 45, 61, and 77 (compare also sources 3, 4, and 6) tell how Mind controls and fashions all things, and originates motion and change. These passages contain the nucleus of the quotations which occur *ibid.*, 156.14–15, 20–21 and 25–28.

The largest group of quotations in Simplicius seem to be meant to serve as source material for Aristotle's long discussion of Anaxagoras' theory in source 17 (187a20 ff.). Thus Aristotle's account in 187a27–31 is illustrated in *In Phys.* 156.10–12, and Anaxagoras' explanation of physical change reported in 187a31 is echoed in the passages which occur at *In Phys.* 163.5–7 and 20–24. Aristotle's statement that Anaxagoras observed that everything comes out of everything (187b1–2) is expanded upon at *In Phys.* 155.21 and 179.8. The "quotation" *ibid.*, 27.10–11, repeated at 157.5, is meant to serve as the source for the similar statement of Aristotle at 187b1–4. Further, the passage in *In De Caelo* 608.26 was probably first brought, or created, to illustrate Aristotle's argument at 187b7–13. The passages in *In Phys.* 34.20, 155.26 f., and 156.1, are probably illustrations of Aristotle's criticism of Anaxagoras in 187b7–13 for positing the existence of an infinite number of entities. Aristotle's criticism of Anaxagoras for having held that "an object can be of any size whatever" (187b13 f.) is most likely the source of the quotation in *In Phys.* 164.16–20. Aristotle's statement in 187b22 that according to Anaxagoras "parts of all these things are actually present in all things" is probably responsible for the choice of *In Phys.* 27.9–10 which occurs again at 156.16–17, and with variations at 164.23–24. Aristotle's argument in 187b27–34 that there can not exist an infinite number of components in each and every thing is probably the source of 164.30–165.1. The remark made by Aristotle in 188a2–4 that the basic particles in Anaxagoras' theory were "real and distinct" entities is echoed in *In Phys.* 157.4–5, and in the other places where we are told that "Nothing else . . . is exactly identical to anything else." The passages *ibid.*, 300.31–301.1 and 156.21 f. probably refer to Aristotle's remark at 188a9–10 that Mind's "aim is to separate." Finally, 188a12 contains Aristotle's statement that "there is no such thing as a smallest size in Anaxagoras' theory," which probably determined the inclusion of *In Phys.*, 164.17–18 in the collection of "excerpts from Anaxagoras."

At least four "fragments" seem to have been chosen in order to illustrate source 21. The one at *In Phys.* 175.13–14, as well as the one *ibid.*, 176.29, were chosen to illustrate the statement in 203a19–23 that Anaxagoras held that the universe is a continuum composed of an infinite number of bodies in contact; the passage at *In Phys.* 164.26–30 illustrates Aristotle's comment, 203a21–24, that "Anaxagoras held that any object in the universe is a mixture just as the universe as a whole is"; and *In Phys.* 156.21–25 illustrates Aristotle's remark, 203a31, that "Mind began its work at a certain time."

Source 24 (250b26), like source 17, contains a statement to which the "quotations" at *In Phys.* 300.31–301.1 and 156.21 f. may have been appended, while source 26 (256b25) may have provided an additional reason for choosing *In Phys.* 156.14–16, as well as 300.31–301.1 and 156.21 f.

Source 29 contains the passage 295a10 f. to which there may have been attached as illustrations the "quotations" at *In Phys.* 155.31–156.1 and 179.3–6 which speak of the separation in which the lighter kinds of matter, viz. air and aether, rose to fill the outermost parts of the universe while the heavier kinds came to the center. Doubtless *ibid.*, 35.14–18 also was intended as an illustration for the same passage in later antiquity when Anaxagoras was mistakenly confused with the "others, like Empedocles" mentioned by Aristotle in 295a16–18, who "say that the speed of the heavens' rotation is greater than the speed of fall of the earth." In the same way, in *In Phys.* 156.22–24, the continued extension of the rotational motion into the future may perhaps be an expansion of Anaxagoras' statement about the vortex attested to by Aristotle in 295a10–13, considered together with Aristotle's statement in source 17, 188a9–10, that Mind's intention is to continue separating the elementary particles in Anaxagoras' theory, and with the false interpretation of source 3 (Plato *Phaedo* 97b8 ff.) current in later antiquity and in modern times [compare Clement of Alexandria in source 253, and Nietzsche (77)], according to which Anaxagoras did not really believe Mind to be directly responsible for any natural processes at all, but made all natural processes dependent on physical mechanisms, in particular, on rotational motion. If these sources and interpretations are taken together it appears that according to Anaxagoras the continued action of the vortex, being the manifestation of the continued action of Mind, was necessary for the further existence of the universe. A passage describing this action could easily have been inserted among the "quotations" of Anaxagoras in the handbooks, although this was clearly contrary to Anaxagoras' theory.

Sources 42 and 43 seem to be responsible both for *In Phys.* 156.21 and for *ibid.*, 164.23–24, and source 44, 429a18–19, for the verb *krateō* in *In Phys.*, 156.21, 22. Source 52 too can be considered one of the passages which influenced the choice of *In Phys.* 156.21. The "quotation" *ibid.*, 163.6–7, above related to source 17, also belongs as an illustration to source 60, 984a13–15, where Aristotle states explicitly that physical change for Anaxagoras was a process of dissociation and recombination.

The description of the mixture in source 67, 989b6–14, probably caused the passages at *In Phys.* 35.21–26 and 155.28 to be selected and included in the handbook of quotations which went under the name of Anaxagoras. A different section of the same source, 989a14–16, was presumably illustrated by *In Phys.* 156.13–17 and 164.24–25.

In source 69 we again have a passage exemplified by *In Phys.* 34.20, and its variations; in 70 one exemplified by *In Phys.* 27.9–10, etc.; and in 73 we have the actual quotation which occurs in slightly changed form in *In Phys.* 155.26–27. Source 74 is another of those passages illustrated by *In Phys.* 164.23–24, etc., and by *ibid.*, 164.26–165.1.

Thus we see that with the exception of the quotation *ibid.*, 157.7–9, which is so obscure that it is impossible to determine to what aspect of Anaxagoras' theory it refers, all the quotations of Anaxagoras collected in Simplicius' commentaries can be shown to be related to passages in Aristotle. (For *In Phys.* 35.3–8, the other exception, see above, section 2. G.) Even the "quotations" of Anaxagoras presented by Sextus Empiricus in sources 241 and 242 doubtless were chosen to illustrate the relativism Aristotle attributes to Anaxagoras in sources 71 and 72. They probably came from a collection different from the one Simplicius had, since it seems that Simplicius tried to copy out all the "quotations" he had.

There is, then, hardly anything in the "quotations" whose preservation cannot be traced to a desire to provide original source material to illustrate Aristotle's arguments, a desire evident in Aristotle's own practice of quoting those he argues against. It seems that the practice, apparently begun by Aristotle himself, of bringing examples from the writings of other thinkers to illustrate Aristotle's account of their teachings finally culminated in the creation of handbooks containing such excerpts.

C. *There Is Evidence Outside of Simplicius' Writings for the Existence of These Handbooks*

We have evidence that such handbooks were in use before the time of Simplicius in the fact that certain authors of late antiquity seem to have knowledge of some of the quotations preserved in Simplicius' works.

In source 271 Origen (Hippolytus?) tells us that according to Anaxagoras "Dense, moist, dark, cold, and, in general, heavy things collected at the center and earth was formed from them when they coalesced. Things contrasting with these—hot, light-colored, dry, and light ones—rose to the outer part of the aether." This passage reveals knowledge of an excerpt similar to those found at *In Phys.* 179.3–7 and 179.8–9, to which it is similar both conceptually and linguistically. It is noteworthy that even though the rest of the material in Origen (Hippolytus?) is part of the textbook tradition found in Plutarch, Galen, Diogenes Laertius, Stobaeus, and elsewhere, this passage is echoed only by Simplicius' "quotation."

In the same way Lactantius, source 356, Themistius, source 404, and Augustine, sources 434–438, by weaving subtle allusions to "quotations" of the kind found in Simplicius' commentaries into the fabric of their writings, also show acquaintance with such handbooks.

4. Conclusion

After Anaxagoras' book was lost, perhaps as far back as the third century B.C.E., handbooks circulated containing certain passages selected from Anaxagoras' book, or chosen from among anonymous quotations and attributed by scholars to Anaxagoras, or reconstructed on the basis of Aristotle's account to resemble Anaxagoras' diction and style. These handbooks were designed mainly to serve as companions to Aristotle (and possibly Plato). The excerpts they contained have left traces in our sources, and Simplicius copied out those he had in order to bring support for his version of Anaxagoras' theory. However, even though for the most part the topics these excerpts cover are among those we know from Aristotle to have been treated by Anaxagoras in his book, and even though their contents are in most cases in consonance with the doctrines of Anaxagoras which we know from Aristotle and from the other early sources, these so-called fragments can not be used as the basis of a reconstruction of Anaxagoras' theory.[5] They do not present a coherent account, since they have been torn from their context and do not form ordered units of any considerable length. The text they present is obscure; it comes from the seventh century C.E. and in the course of a millenium of transmission it was subject to the ravages of copying, to interpolation, and to amalgamation. They can be assigned no more importance than their late chronological position relative to the time of Anaxagoras indicates, and their usefulness for the modern scholar is limited to the role they are able to play as additional evidence concerning the development of the tradition about Anaxagoras, and to some possibly interesting but exceedingly dubious information they are able to supply on Anaxagoras' use of single words and isolated phrases. The so-called fragments are assuredly very far, however, from direct quotes from Anaxagoras' book.

Chapter Four

A SURVEY OF MODERN INTERPRETATIONS OF ANAXAGORAS' WORK

1. Introduction

In this chapter we shall review briefly some of the opinions held by scholars who have studied Anaxagoras in modern times. It is not our intention to be exhaustive. Our survey is for the most part arranged chronologically, except where we have chosen to bring together all the writings of one author. It is hoped that this arrangement will throw into sharper relief the odd development which the interpretation of Anaxagoras has undergone; it will also allow us to point out some interesting instances where a later "innovator" unacquainted with an older interpretation revived it as his own. A full alphabetical listing of each author and his works can be found under the heading "Bibliography of the Modern Literature"; the numbers in parentheses in this chapter refer to the numbers given there.

A few general remarks are in order, to explain the way we have chosen the material appearing in this survey. There is a great deal that virtually all the treatments have in common. Consequently we shall outline here once for all the body of material which tends to recur, in order to avoid repeating certain statements over and over. Only where a treatment diverges from the common ground, or limits itself to just one aspect of Anaxagoras' life and thought, will the fact be noted. Each item of the survey, then, will include only those elements peculiar to the book under discussion; for the rest it can be assumed that the work in question shares the common features. Thus it may occur that the greater part of the contents of an individual work will not be mentioned.

The recurrent features are the following:

(1) An unchronological approach to the ancient testimony about Anaxagoras: It is universally assumed that all the passages appearing in Part II of this book are a priori equally valid sources of true information about Anaxagoras. Certain writers on occasion—but only seldom, and then usually to reject Aristotle's testimony!—express a preference for one ancient writer over another, or for one part of a writer's testimony over another part, but this bias is, with but very few exceptions noted in the survey, never supported on historical or

chronological grounds, but always on subjective or "reasonable" ones.

(2) An almost entirely uncritical acceptance of the quotations brought by Simplicius as Anaxagoras' own words: The work of standardizing these quotations has been left for the most part to fragment-collectors, and there has been no serious challenge to their conclusions. Only in a few places has a reading here and there been suspected. On the other hand there is very little agreement on the 'quotations' of Anaxagoras' words by authors other than Simplicius which are to be considered genuine. This entire subject has been treated in detail in Chapter 3 above.

(3) An acceptance of the 'fragments' as the unique basis for understanding Anaxagoras' theory: The tendency to resort exclusively to the 'fragments' has become less and less contingent on their agreement with other ancient accounts (e.g. with that of Aristotle) in the course of time, so that a paradoxical situation has arisen in which reliance on the fragments alone has become more the rule the more divergent the explanations offered for these fragments.

(4) An acceptance of one of the traditional text-book versions of Anaxagoras' doctrines, especially as regards his particular theories and proverbial sayings attributed to him: We have not deemed it important in every case to note which of the standard ancient accounts (Diogenes Laertius, Plutarch, Origen[Hippolytus?], etc.) an author has adopted, mainly because it is of no great importance (in view of [1] above), often not even to the author himself. Exceptions have frequently been noted; but for the most part the authors do not really seem to feel that it matters, for example, whether or not Anaxagoras held that the sun is larger that the Peloponnesus. We shall often refer in the detailed survey below to a "standard account," by which we mean an account put together in one way or another from the ancient text-book material. We shall also use the expression "standard collection of sources" to refer to the kind of account typified by Diogenes Laertius', in which earlier sources are juxtaposed (either in direct quotation or in paraphrase) with little critical appraisal (see [1] above) and little attempt at order (except perhaps order by subject-matter, as in Plutarch). These collections make no claim to being exhaustive and never reveal the principle which governed their selection. Many have been made in modern times, the latest being the ninth edition of Diels-Kranz (*q.v.*).

We shall prefix to the discussion of each work a listing including the name of the author, the bibliography number, a shortened title, the date of publication, and occasionally where necessary a chapter or page reference. All references to numbered sources are to Part II of this book. Direct quotations from books and articles not written in

English will be brought in our translations (unless they are taken from a published translation, as indicated in the Bibliography). Except in a few instances we have refrained from direct criticism, allowing the reader to judge our attitude by comparing the stated views with our own account in Part I of this book.

2. The Seventeenth Century

R. CUDWORTH (30), *The True Intellectual System of the Universe* (1687) (I. 98, 118; II. 244; III. 424): Cudworth is credited by Carus ((21); p. 432) with being the first to point out that quotations of Anaxagoras' words are to be found in Simplicius. Cudworth brings the long quote on Mind (source 623) in full, but he uses the fragmentary quotations only as supporting evidence for the fuller picture of Anaxagoras' doctrines found in Plato and Aristotle.

Anaxagoras held that matter is made up of an infinite number of atoms, many of them resembling one another. According to him the doctrine that there is absolutely no creation or destruction applies even to perceptible qualities, so that all the various qualities must be permanent properties of the different atoms. Incorporeal Mind controls and arranges all things. Anaxagoras was thus basically a theist, though we see from Plato's criticism (source 3) that he was still under the influence of materialism and did not really make full use of his new concept, Mind.

P. BAYLE (6), "Anaxagoras" (*c.* 1695) (Vol. 2, p. 20): This is a long article, written with biting sarcasm, and filled with statements having political overtones. For example, the following argument occurs in the midst of an extended attack on Moreri's Encyclopedia (the later editions of which subsequently removed most of the errors objected to by Bayle): Moreri describes Anaxagoras' theory of matter as saying that "the whole world is composed of identical parts." This however is a singularly poor choice of words, according to Bayle, since it uses the word "whole" without distinguishing clearly between its collective meaning ("entire") and its distributive meaning ("each and every part"), the latter being the meaning intended here. It is, says Bayle, as if we considered a town and divided it into ten classes according to wealth, the first class containing people who have up to one thousand francs, the second class people having from one to two thousand francs, and so forth. We *might* then say that the whole town is made up of equally rich citizens ("toute cette ville est composé de bourgeois également riches"), but this would be a misleading use of the word "whole" . . .

Bayle's article shows no acquaintance with Simplicius. It is a well documented standard account with a standard collection of sources, showing much erudition and a wide acquaintance with ancient literature. Bayle thinks Anaxagoras' theory of matter is on the whole rather silly, and he attacks it using Lucretius' arguments (source 97), brought in the name of their author, and using also Aristotle's arguments (source 17), brought with the amusing disclaimer that they are not taken from Aristotle and with the innocent remark that any resemblance to Aristotle's arguments is purely coincidental. (Aristotle was no more popular then than he is today!) Of the theory in general Bayle says, ". . . It seems to me that it is entirely foolish, and that in general the ideas of ancient thinkers who spoke of a chaos are no less confused than the chaos itself" (". . . il me semble qu' elle en est toute farcie; et qu'en général, les idées des anciens qui ont parlé du chaos, n'étaient pas moins embrouillées que le chaos même.").

Bayle admires Anaxagoras' theory of an incorporeal Mind ruling over matter. He violently attacks (p. 37) the church fathers' accounts of Anaxagoras' theory on the grounds that they put it in a bad light, as for example when Justin (source 200) omits to mention the Theory of Mind.

3. The Eighteenth Century

ZEDLER (110), "Anaxagoras" (1732) (Vol. 2): This is a standard account, with no mention of Simplicius.

M. HEINIUS (56), "The Life of Anaxagoras" (1752): Heinius at the outset (p. 313) announces that his method is to consider *all* the ancient testimony. He then proceeds to collect a very large number of references to Anaxagoras, translating many of them into French. The article puts together all the information available on the dates and events of Anaxagoras' life, with hardly any criticism of the reliability of the ancient accounts, and with a great deal of open admiration for Anaxagoras. The views of Heinius' modern predecessors are reviewed throughout the article.

M. HEINIUS (57), "On the Writings and Doctrines of Anaxagoras" (1753): This is a continuation of the preceding article. Though Heinius knows Cudworth's work, he nowhere quotes Simplicius or shows any awareness of the existence of Simplicius' quotes of Anaxagoras. He begins (p. 362) by warning that the ancient accounts are too fragmentary to permit a detailed reconstruction of the theory, so that he will merely bring the testimonies without entering into controversies about their meaning. He then proceeds to give his own interpretations.

Concerning the theory of homoeomeries, Heinius is sure that Anaxagoras could not have been so silly as to believe that bone was made of little pieces of bone, etc., or that *everything* is in everything—a statement which clearly violates the principle of sufficient reason. In fact Anaxagoras was a pure atomist, for whom matter was made up of a number of different classes of particles. The variety of classes gives rise to a variety of objects, while the identity of particles—in size and shape—within each class (which identity is meant by the term 'homoeomery') gives rise to similar objects, e.g. homogeneous substances in mass, or similar members of one species of animal. The phrase "All is in all" is to be taken broadly, to mean that the same basic building blocks go into all things. Heinius' analysis here is less than crystal clear.

Anaxagoras, far from being an atheist, believed in God as the Author of all, Whose divine hand could be seen throughout nature.

The article ends (p. 394 ff.) with a paean of praise for the great accomplishments of ancient science. Theories current in the mid-eighteenth century are brought for comparison, and the fact that ancient science discovered many truths confirmed in modern times is taken to be ample justification for studies such as this.

C. MEINERS (71), *Book V: Empedocles, Anaxagoras, Democritus, Zeno, and Melissus* (p. 664 ff. on Anaxagoras), (1781): This is a standard account. Meiners knows all Simplicius' quotes and uses them, though he relies primarily on Aristotle; he also makes considerable use of Bayle (6). He thinks that Anaxagoras has never been superseded as a person and as a thinker, even when in error.

Mind is a substance (p. 670), which has the properties of being omniscient, all powerful, etc.

D. TIEDEMANN (101), *Ch. 14: Anaxagoras* (p. 312 ff.), (1791): Aristotle is taken as the basic source, while the quotes from Simplicius are used together with other testimony in an unassuming manner. The results are interesting:

Anaxagoras applied the doctrine "nothing comes to be from nothing" ("aus nichts wird nichts") to qualities as well as to matter (p. 316) coming up with the theory that bodies are composed of an infinite number of infinitely small particles having all the properties of the substances in mass, each body being made out of particles like the whole. Tiedemann hastens to object, however, (p. 319) that since the homoeomeries, like all other bodies, are infinitely subdivisible, they are not in fact eternal—a defect not shared by the basic particles of the much superior theories of Leucippus and Democritus.

Now matter taken by itself remains at rest (p. 324); hence Anaxagoras was led to the concept of a "substance which initiates motion" ("erste bewegende Substanz"), Mind. Though not the first to speak of a source of motion, he was the first to call it Mind ("Verstand"), which was an important step forward. Mind is totally different from all matter; Anaxagoras called it God and in so doing founded Deism and started us off on the road to dualism—though to be sure he was not a Manicheist as some hold (p. 333).

Aristotle tells us (source 35) that the ancients—including of course Anaxagoras, who was an ancient—thought the aether to be supernatural, divine. This shows that aether (or fire, since they were the same for Anaxagoras) must have been the substance of which Mind was made (p. 329). This raises two problems: First, if Mind is aether, how is it different from all matter (p. 332)? Second, how did Anaxagoras differentiate Mind from Soul (p. 344)? Could it have been by calling the World-Soul air, as Plutarch seems to hint (source 180)? Also, how did Mind move matter (p. 335)? Was it by penetrating throughout the whole mass, or by giving an initial blow? Another problematic statement is Aristotle's that Mind had to be free from the admixture of matter in order to know all things. Why is this so (p. 331)? Could we have here a hint of a doctrine of perception through similarity, i.e. a doctrine that like knows and perceives like, so that since nothing can be like *everything* in the case of a mixture, Mind has to be like nothing at all? Tiedemann does not explain this last statement (which is surely odd), and he is completely unaware of Anaxagoras' theory of perception through the interaction of *opposites*—a theory mentioned explicitly nowhere in the ancient sources outside of the fragment *On Sense Perception* attributed to Theophrastus and not generally known in Tiedemann's time.

F. A. CARUS (20), *On The Sources of Anaxagoras' Cosmic Theology* (1797): Carus' method is to use the quotes from Simplicius as primary sources, closely supplemented by Aristotle; he sees special importance in Aristotle because Anaxagoras may have changed his mind on certain matters after publishing his book, and in Aristotle we would always get the latest version. At any rate, Aristotle is to be preferred to anyone later, and in general later sources are to be accepted only in so far as they do not contradict Aristotle.

This article is a long study of the concept of Mind as found in earlier authors. As far as the details of Anaxagoras' doctrine are concerned, this is a standard account; it contains a long attack on those who say that Mind is aether. Some illustrations of the points Carus makes are the following: Anaxagoras did not call Mind 'God'; Anaxagoras must have been in Egypt, for otherwise he would not have known about the rising of the Nile; Athena and Zeus became Technical

Skill and Mind, respectively, in Anaxagoras' theory. In general, everything in Anaxagoras' theory is traced back to an earlier origin, in the spirit of those investigations that assume that there is nothing new under the sun.

F. A. CARUS (21), "Anaxagoras and the Spirit of His Time," (1799): This article is essentially a sequel to the preceding one, and it is about as interminable. Very little is said about Anaxagoras' doctrines, but we find that Anaxagoras was tremendously influenced by his predecessors and contemporaries all over, mainly by the Persians (hence the charge of Medism brought against him) (p. 406 ff.). It is typical of this genre of writing, which bends all efforts towards 'placing a man in his historical context,' that when all is said and done we have hardly any idea of the man's own coherent theory, since he is supposed to have taken from others all the material he digested and put together into a system of his own.

Carus solves the knotty problem of Anaxagoras' trial (p. 466 f.) by showing that the various accounts could be made to agree more or less if we assumed that in fact there were two accusations brought against Anaxagoras at two different times in his life.

F. A. CARUS (22), "Anaxagoras" (p. 213 in his History of Psychology): We are given more concrete information on Anaxagoras in these few pages than in the whole of the preceding two articles. We are told that for Anaxagoras matter is made up of seeds which already contain in them all the properties of things. These seeds were mixed together until a finer substance broke forth, Mind substance, pure and fine and different from everything else. This substance is not corporeal, and not incorporeal (p. 215); it is not just a force, but a kind of world spirit, a primary source of order in nature ("ein Princip der Gesezzes in der Natur") whose nature is distinctly teleological ("zwekmaessig"). Through Mind—rather than through the senses—truth is reached; but since Mind is in all animals, the differences among animals and between man and the animals resides in their physical structure. Actually, Anaxagoras removed God from physics, and explained the wonders of nature by natural processes; but because he said that the world is intelligible, he was led to a kind of dualism.

W. G. TENNEMANN (100), *Ch. 8: The Philosophy of Anaxagoras* (pp. 368 ff.), (1798): Tennemann makes considerable use of the quotes brought by Simplicius. According to him, Anaxagoras was primarily an astronomer, whose two major contributions were the introduction of Mind into philosophy, and the introduction of a love of learning into Athens (p. 368).

Matter contains in it all the infinitely varied different qualities observed in bodies, and matter possesses these qualities eternally;

so that there must be an infinite number of different basic substances. Any body is indefinitely subdivisible into parts identical to the whole (p. 383) in all their properties, and so small that they are imperceptible, viz. the homoeomeries. Also (p. 385), all things have all other things mixed in them. Thus (p. 388) the homoeomeries are eternal (though bodies made from them are not), and each homoeomery has all things in it, so that "each subdivision is then a *universe* in miniature" ("Jeder Theil waere also ein *Universum* im Kleinen"; p. 385). This somewhat vague picture of matter is nowhere made really clear.

Matter alone does not move without a source of motion, Mind, which is essentially God (p. 396 f.). Anaxagoras however could not use the name 'God' because of its associations in the popular mind. Mind is incorporeal (p. 403), though in so far as Anaxagoras uses adjectives (such as "penetrating") appropriate to matter to modify Mind, he shows that he did not conceive of incorporeality in all its implications (p. 404). Mind is not all-powerful, since it cannot achieve full separation of the homoeomeries; its function is simply to start things off by means of rotational motion (p. 413), after which everything proceeds by purely physical mechanisms: "Indeed Anaxagoras was more a *physicist* than a *metaphysician*" ("Uebrigens war Anaxagoras mehr *Physiker* als *Metaphysiker*"; p. 419).

4. The First Half of the Nineteenth Century

F. SCHLEIERMACHER (94), in his *History of Ancient Philosophy* (p. 43): The basic constituents of matter in Anaxagoras' theory were homoeomeries, which had inherent in them all the different properties of existing things (p. 43). According to Schleiermacher (p. 48), Anaxagoras did not present a really comprehensive theory of the homoeomeries —which was lucky for him, since science had not progressed sufficiently in his time to allow the formulation of a really thorough theory of matter; nor did he succeed at all in relating organic and inorganic substances, or particular and general ones, since he spoke only of dissociation and recombination (spatial juxtaposition) and entirely omitted any reference to the concept of chemical combination (p. 44).

Mind is in some respects material, in other respects incorporeal, and in so far as it was incorporeal for Anaxagoras it served to initiate Theism (but not religion with a personal God). Mind contains in it the forms of real things (p. 46); Anaxagoras was thus a real precursor of Platonism. Anaxagoras' book began with the statement of the antithesis between Mind and matter. (This statement of Schleiermacher's belongs to the period when people believed the ancient writers who said that Anaxagoras' book began with the statement "In the beginning all things in the universe were together; then Mind came and separated them.") The book then proceeded to a statement of their union (a marked Hegelian conception). But Anaxagoras in fact never succeeded in transcending the dualism of mind and matter by a higher unity.

The theory contains a number of mythical elements. Thus Mind, which is pure life, and its antithesis, chaotic matter, which is pure death, both have mythical origins, as does the problematic statement that Mind enters matter from the outside. Indeed we can only understand the original separation between Mind and matter to have been conceived by Anaxagoras as an abstract separation (i.e. a conceptual distinctness) rather than a real one (p. 47).

The cosmogony is divided by Anaxagoras into two major periods: the first is inorganic and involves the formation of large-scale inorganic configurations, the second organic and involving the creation of living beings (p. 48).

J. T. HEMSEN (59), *On The Life and Philosophy of Anaxagoras of Clazomenae, from the Point of View of the History of Philosophy* (1821): This little monograph is written in a simple, unpretentious style. It begins with a long discussion of Anaxagoras' life. Thus, for example, we learn that there is no objection on the basis of chronology to accepting the tradition that Anaxagoras studied with Anaximenes (p. 7 ff.); and that the resolution of the problem of the trial can be found in assuming simply that there were two accusations (pp. 25 ff.; see CARUS above).

When discussing Anaxagoras' doctrines, Hemsen starts the practice which has been followed often since of referring to Simplicius—who brings in his commentaries on Aristotle, among other things, Aristotle's own words and opinions—as the primary source for information found in Aristotle. Hemsen adopts many of Tennemann's positions (*q.v*), e.g. that in Anaxagoras' theory the homoeomeries have all perceptible qualities permanently attached to them (p. 75); that each homoeomery has some of all things in it (p. 66); that Anaxagoras was more of a physicist than a metaphysician (p. 78); that Anaxagoras didn't call Mind 'God' because of the mythical associations that people had with the name (p. 80); that Mind was entirely different from matter (p. 105)—though Hemsen nowhere takes a firm stand on whether or not Mind was really incorporeal.

Hemsen prefers Anaxagoras to Democritus, since the latter reduced everything to matter plain and simple, while the former considered qualities too to be basic (p. 76). In general we have here a standard account.

E. SCHAUBACH (93), *All the remaining Fragments of Anaxagoras of Clazomenae; and Concerning the Life and Philosophy of Anaxagoras* (1827): This is the first of a series of systematic collections of the very words of Anaxagoras, culled from ancient sources—but especially from Simplicius (it took a century and a half for Cudworth's discoveries to bear fruit in the case of Anaxagoras)—and arranged in their "original" order (see Chapter 3 above). To these "fragments" (and the word henceforth comes to mean "the fragmentary quotations of Anaxagoras' own words"; whereas it had previously referred to all the remaining fragmentary accounts of Anaxagoras' doctrines found in the ancient literature) is added a long discussion of Anaxagoras' life (p. 1 ff.) and writings (p. 57 ff.), followed by a standard account of his doctrines based on a standard collection of sources.

Schaubach believes that in Anaxagoras' theory every piece of matter, no matter how small, contains every kind of substance in it; and that Mind is incorporeal.

W. SCHORN (95), *All the Remaining Fragments of Anaxagoras of Clazomenae and of Diogenes of Apollonia,* (1829): This second study of the so-called fragments followed quickly on the heels of the first. The two were subsequently always treated as two contemporaneous classics on the subject.

C. A. BRANDIS (12), *Part II, Section II, Ch. 52: Anaxagoras of Clazomenae* (p. 232) (1835): This is a long, detailed examination which is essentially a standard account. Aristotle is used as a very important source which is carefully weighed against others; Brandis even makes use of arguments from silence in Aristotle. Indeed, according to Brandis, Simplicius may well have had only *fragments* of Anaxagoras' first book before him (sic! p. 238).

Brandis gives a long discussion of the chronology of events in Anaxagoras' life (p. 233 ff.). In Anaxagoras' theory of matter, all things are contained in all things and the nature of each thing is determined by the predominant component, although it is not clear if numerical or qualitative (i.e. intensive) predominance is meant by Anaxagoras (p. 242). The seeds of all things are infinite in number and in smallness and are qualitatively determinate (p. 243).

Mind is essentially God for Anaxagoras, and is incorporeal (p. 248 ff.), requiring no material substratum for its existence, but existing instead all by itself. Anaxagoras did not really mean to say that matter rested for an infinite length of time and then began to move: he merely used language which conveyed this impression in order to accentuate the complete immobility of matter alone, and its contrast with Mind, the source of all motion (compare SCHLEIERMACHER, above). This is *not* to say, however, that Anaxagoras intended to introduce a neo-Platonic dualism which contrasts the pure world of ideas with the material observable world . . . (p. 250).

The ability of living beings to perceive depends on the structure of the material components in their sense organs so that, since this structure is never identical in any two living beings, the *perceptions* two observers have of the same event are never identical (p. 251). This led Anaxagoras to a kind of skepticism, though he held that *intelligence* is entirely independent of external material structure. Perception and intelligence are both manifestations of the working of Mind.

H. RITTER (86), *Book III, Ch. 8: Anaxagoras of Clazomenae* (p. 281), (1838; English translation of a German original which appeared in 1836, itself a reworking of versions of various parts of the book which appeared from 1821 on; so that much of the material was available to the authors cited above who published after 1821): We have here much of the standard material, but a number of novel interpretations. Ritter's method of selecting his sources is somewhat of a mystery. After rejecting much of the later tradition about Anaxagoras' astronomical theories (p. 284, Note 2, where he writes, "How little trustworthy in such matters are the statements of later times, is seen from the assertion, that Anaxagoras had predicted the fall of a meteoric stone") Ritter in the next sentence accepts Vitruvius' lone, late testimony that Anaxagoras wrote a book on perspective; and after accepting (p. 299) Simplicius' assertion that in fact in Anaxagoras' theory motion did not have a beginning in time, Ritter launches a strong attack on Simplicius (p. 301, Note 1) for being a perverse syncretist!

Ritter thinks one of the basic points of the whole theory is that there is no vacuum, no gap or separation in the matter which fills space (p. 287), but all things are inseparably linked together. Thus by the words "all things are in all things" no mixture is indicated; rather the statement "that in all things there is a part of the All" probably signifies (p. 289) "nothing else than that, by the all-pervading connexity of the primary elements, the action of all is in each." (Sic!) Indeed, even the statement "no seed is like another" is but a natural result of "the consideration, that individuals are determined by their respective relations to the whole" which, being different for each individual, make each one unique.

The basic elements which made up matter for Anaxagoras were qualities, "which are accidents of different things at different times" (p. 304) (it is not clear whether these qualities belong only to perceptible objects, or whether Ritter understood these qualities to be immutably linked to the basic particles); and "constituent particles which belong only to certain genera, such as flesh, blood, marrow, bone, gold, corn, lead, etc. etc.," with special weight placed on organic types, since Anaxagoras concentrated his attention on providing explanations for organic phenomena in the framework of a mechanistic theory.

Anaxagoras then introduced a second feature into the theory, Mind, on the basis of the reflection "that the order of mundane things must have its cause in a rational being" (p. 290 ff.)—a reflection much the same as was made earlier by Heraclitus, Xenophanes, and others. Anaxagoras indeed stressed the contrast between Mind and matter, thus introducing a dualism which could no longer be united under a single head. (The influence of Hegelian philosophy on all the modern writers of this time is evident.)

Mind was used by Anaxagoras only to initiate motion, which then continued to propagate itself. There is however no temporal beginning to motion in Anaxagoras' theory, as Simplicius correctly observed (p. 299). Aristotle's explicit statement to the contrary must have simply arisen from a misunderstanding of the theory. We know that there could not have been a beginning of motion in time, since as you go back in time, the influence of Mind (i.e. the vortical motion) must diminish proportionately and hence must become smaller and smaller without ever vanishing; so that in fact motion, Mind, and matter co-exist eternally.

The cosmogony proceeded by the separation of matter into progressively purer elements, first from chaos to the four elements, then to the purer organic elements. There is basically one world, but "in a subordinate sense" also a plurality of worlds (by which Ritter probably means a plurality of inhabited bodies within the one world, though he nowhere makes himself clear). Life on other heavenly bodies, such as the moon, is even better than life here (p. 312) since the force of Mind (which is equivalent to the rotation) is greater there (sic!).

H. RITTER and L. PRELLER, *History of Greek Philosophy* (First edition 1838): This is a standard collection of sources on ancient philosophers. It was regarded as *the* standard collection before Diels, but though such a standard work was available, classical scholars then still frequently felt that it was worthwhile to return to the original works from which the excerpts in Ritter and Preller had been taken.

F. J. CLEMENS (25), *On the Philosophy of Anaxagoras of Clazomenae* (1839): This more or less standard account is based on a large number of ancient testimonies and is one of the few to make use of Philoponus as a serious source of information.

According to Clemens the homoeomeries are simple, elementary particles ("particulae rerum elementariae"; p. 33) which compose all things. The statement that all things contain all things refers, then, not to the basic particles, but to composite perceptible objects ("illud *pan en panti* nihil aliud significare potest, quam in re composita omni homoeomerias omnis generis inesse"; p. 44).

Mind is a pure incorporeal substance which originates motion and arranges things. All the properties attributed by Anaxagoras to Mind were adopted by him directly from his predecessors.

Clemens views Anaxagoras as a truly great physicist, whose theory more closely resembles modern (i.e. early nineteenth century) atomic theories than does the theory of Leucippus and Democritus, since modern theories also postulate the existence of atoms having definite properties. To be sure, modern physicists know more physics than Anaxagoras did, since they know what substances are elementary and they can identify which of a finite number of elements are in any given body (not saying, as Anaxagoras did, that each body contains some of every substance). But this in no way diminishes Anaxagoras' stature.

Clemens thinks that *apeiron* means 'indefinite' when applied to air and aether in Anaxagoras' theory, but that in its other applications it generally means "infinite."

F. BREIER (13), *The Philosophy of Anaxagoras of Clazomenae According to Aristotle* (1840): This is a monograph whose avowed purpose it is to reconstruct Anaxagoras' theory on the basis of Aristotle's testimony. Other sources, including the so-called fragments, are used as supplementary evidence, though Breier often places them on an equal footing with Aristotle. The book just misses being really good, since Breier just misses reading Aristotle really carefully; this is especially true where Breier discusses Anaxagoras' theory of matter. Breier's praise for Aristotle is so extravagant (pp. 50 ff., 79, 82) that it almost verges on hero-worship.

The book opens with a long discussion of the history of the misunderstanding of the word "homoeomery" in the ancient world. Breier then proceeds to reconstruct the theory of matter: There is no difference between the homoeomeries and everything else—all are composite mixtures of infinitely small pieces of all things, though the "four elements" (especially air and aether), being the most abundant ones which lend the whole mixture of matter its gross features, are most composite of all. Anaxagoras did not believe in particular kinds of atoms but in "things" ("Dinge"—a word that reverberates over and over again through the generations of German scholars who wrote on Anaxagoras, and which was later rendered into English as either "things" or "entities") just like the things we see around us: both organic and inorganic things, which are put together to form ordinary objects by simple juxtaposition (and not by chemical combination).

According to Breier (p. 45 ff.) *Aristotle* reports that Anaxagoras considered matter to be made up of quality-pieces as well as homoeomeries. (This view of Breier's is based especially on a misinterpretation of source 17, which Breier takes to contain an attack by Aristotle on Anaxagoras for corporealizing pure qualities.) Breier however thinks that Aristotle erred here, and on the basis of the fragments and of the necessarily primitive state of philosophy in Anaxagoras' time (when no one could possibly have attained to such an abstract conception of quality as is necessary in order to consider pure qualities as substances!), he concludes that in fact Anaxagoras held that qualities simply modify matter (p. 48 ff.).

Mind is incorporeal, though the language used by Anaxagoras was later misconstrued to mean that Mind was a substance (p. 63). Though Mind knows the future since it is omniscient, its work is not really endowed with the teleological attributes some have assigned to it; and though it was employed in Anaxagoras' theory primarily to initiate motion which later went on of its own, it still plays a role in nature since it controls the motion of the heavenly bodies (p. 71).

Breier discusses at length (p. 73 ff.) the problem of the relation between Mind and life in Anaxagoras' theory. He concludes that Mind is in all things, though in the inorganic world it manifests itself only indirectly through the initiation of motion, while in living things it manifests itself directly. In the inorganic world Mind's action is not entirely free, but is limited by the absolute immutability of the basic substances; in the living world Mind is prevented from manifesting itself entirely in each living thing by the *kinds* of living being (i.e. by the kinds of physical structure) in which it is found. "But there is all in all only *one* Mind, even though it is limited in varying degrees in various circumstances, and even though it manifests itself now more, now less." ("Ueberall aber ist es der Eine Geist, wenn er auch in seiner Thaetigkeit mehr oder minder beschraenkt ist, und sich in der Erscheinung hier als ein grosserer, dort als ein kleinerer darstellt"; p. 77). (See the beautiful summary on p. 78.)

A. KRISCHE (64), (Cicero's Account of Anaxagoras) (p. 60) (1840): This is a detailed analysis of source 108 in which an Epicurean background is discerned; and the detailed doctrines of Anaxagoras (based on the so-called fragments, which Krische apparently assumes Cicero to have had before him in one form or another) on which the passage is based are brought.

W. S. VAN REESEMA (83), *On the Fundamental Concepts of Par-*

menides, Anaxagoras, and Protagoras, and on Plato's Opinion of them: Chapter II. On Anaxagoras (1840): This is a fairly extended account of Anaxagoras' basic theory.

Matter is made up of tiny distinct universes, monads, containing within them *everything*. Mind sorts these out and joins like to like, forming the world we know. Van Reesema does not give a clear picture of how exactly various bodies receive their properties by a juxtaposition of little universes; but he points out that since Anaxagoras did not admit of the existence of qualities in his system, all qualitative differences were reduced to quantitative ones.

The author praises Simplicius for his interpretation of Anaxagoras' theory in terms of two separate realms of reality containing two separate ordered universes.

C. ZEVORT (112), *Anaxagoras* (1843): This book contains a fairly standard account based on a large standard collection of sources, most of which are translated into French; in fact this is one of the largest collections of sources translated into a modern language. Zevort uses the so-called fragments as his real authority since other ancient writers, like Aristotle and Simplicius, often misinterpreted Anaxagoras under the influence of their own theories, despite their desire to be impartial. Zevort's reliance on the fragments appears side by side with the often repeated assertion that Anaxagoras wrote very unclearly and that much of Anaxagoras' theory was doubtless not even made clear in his own writings (see e.g. p. 46). Thus for example Zevort thinks that it was doubtless not any easier to learn from Anaxagoras' book than it is from Aristotle (sic!) or from Simplicius whether Anaxagoras considered the original mass of matter to be simply a mass of plain, undifferentiated matter or an aggregate of distinct elements (p. 46).

Anaxagoras' great new idea concerning matter was that matter left all by itself is immobile and inert. Matter is composed of homoeomeries, which are similar *elementary* particles, indivisible and infinitesimally small, so that any body, however small, contains an infinite number of them (and hence can contain with no difficulty *some* of all types) (p. 65). These homoeomeries have all the different properties observed in perceptible objects (p. 61); they fall into classes of similar particles, each *class* being referred to by the term *sperma* (seed), with both the number of different classes and the number of members in each class being infinite (p. 53 ff.). The expression "all is in all" refers, then, to perceptible objects rather than to homoeomeries (compare CLEMENS above). Aristotle misunderstood all this, in particular the distinction between homoeomery and seed, and between simple elements and substances in mass; had Aristotle understood the theories properly, all his objections would have fallen by the wayside (p. 56).

Mind, which is essentially God (p. 92), is material; it is thus not set up over against *matter*, but against the *mixture*, since *it* is made of a simple, unmixed substance (p. 67) which can serve as a source of motion, action, intelligence, and design (p. 72 ff.). Anaxagoras' system thus combines *experience* and "something beyond experience" (a "donnée supra-sensible"; p. 68) which he uses in *explaining* perceived phenomena. The accusations of Socrates and Aristotle are therefore totally unfounded: for though it is true that Anaxagoras resorted to mechanistic explanations of individual phenomena, he was doing just what any physicist would properly do, when he placed Mind at the pinnacle and made it the point of departure and the source of all, and then studied its effects on matter by studying the physical behavior of matter.

In Anaxagoras' theory, the minds of individual living beings are related to the cosmic Mind much as finite objects are related to the universal mixture: the individual mind is a kind of concentration of the universal Mind in an individual body (p. 90), a kind of local, finite manifestation of infinite Mind (p. 135). Individual living things, then, are not distinguished by their minds, but "by the *container* of the soul, by the organs which limit its action" ("à l'enveloppe de l'esprit, aux organes qui limitent son action"; p. 135).

Mind began acting at a certain time. We do not know what it was doing before then (p. 98). It created one universe, containing within it many inhabited worlds and planets.

Anaxagoras' theory of sense-perception is not very good, but it is a distinct advance over his predecessors' theories which hold that perception occurs through the interaction of similar things (p. 147). His theory leads to skepticism, since all objects and all sense organs are compounds of the material elements, and no two people have sense organs identical in composition; so that no two people perceive the same thing.

E. ZELLER (111), *Ch. 3 of Section 2 of Part I: Anaxagoras* (p. 864) (1876⁴; the first edition of this book was put out in 1844): This is a detailed standard account covering a large collection of sources, with considerable weight given to Aristotle's views. There is a very long note (p. 865, Note 4) the beginning of which is essentially an article on the chronology of Anaxagoras' life. Among other things Zeller holds that Anaxagoras was strongly influenced by Parmenides, and that he took into account the theories of Empedocles and the atomists, differing from the atomists in that he held that matter is indefinitely subdivisible and that substances are qualitatively differentiated from one another; in fact, Zeller thinks that Anaxagoras used the results of all his predecessors with the exception of the Pythagoreans.

Mind is immaterial. On the one hand it has some aspects of a personal God, on the other hand it is impersonal, the distinction not being clear in the surviving testimony, and probably not clear even to Anaxagoras himself (p. 889 ff.). On the one hand Mind is a theistic concept, on the other hand it has many aspects of a *force* in Nature (see esp. p. 892, Note 2). On the one hand Mind seems to work purposefully according to a plan, on the other hand it seems to work causally through mechanical mechanisms. In none of these cases does Zeller think the theory has succeeded in making sharp distinctions. Here as elsewhere Zeller brings all the sides of every question he thinks appropriate, and in many cases he concludes that each view has some merit.

Anaxagoras believed in one world, with other inhabited bodies in it, e.g. the moon (see p. 901, Note 4). He could not have believed in many worlds since the unity of Mind and the centrality of the earth relative to the cosmogonous rotation would be incompatible with the assumption of more than one world.

The mind that appears in living beings is the same as the cosmic Mind, but differs in quantity from being to being.

The rest of the account is more or less standard.

5. The Second Half of the Nineteenth Century

F. MULLACH (76), *Fragments of the Greek Philosophers* (1860): This work contains the so-called fragments, with a brief introductory standard account of Anaxagoras. It is one of the standard works on early Greek philosophy used in the last half of the nineteenth century.

A. GLADISCH (51), *Anaxagoras and the Israelites* (1864): The author has also written treatises on the Pythagoreans and the Chinese, the Eleatics and the Indians, Empedocles and the Egyptians, and Heraclitus and Zoroaster. In each case he seeks the true origins of the ideas adopted by the Greek philosophers. The book on Anaxagoras draws upon a very large collection of ancient sources.

Gladisch finds that Biblical Judaism and Anaxagoras' philosophy basically agree, though they differ in the form of presentation since the former places the emphasis on religion, the latter on philosophy. It is highly probable that Anaxagoras read the Bible and wrote under its influence.

For example, the general features of the Biblical cosmogony agree with Anaxagoras'. The Bible too, according to Gladisch, does not speak of creation out of nothingness, but of the formation of the world out of chaos. The two accounts (a) speak of light and dark substances in the chaos; (b) hold that living things were formed out of earth;

(c) show man receiving dominion over the earth; and (d) depict the creation at the hand of God as being good.

The main subject of Gladisch's work is the correspondence between Mind, Anaxagoras' crowning conception, and the Jewish God.

The book contains a great many learned discourses about Biblical interpretation in addition to those about Anaxagoras' doctrines.

ALEXI (1), *Anaxagoras and His Philosophy, According to the Fragments in Simplicius' Commentary on Aristotle* (1867): Basically a translation and commentary of the so-called fragments, using the edition of SCHORN (95), Alexi's interpretation is a combination of Neoplatonism and Hegel.

Anaxagoras' picture is an abstract one; he uses temporal language when he wishes to distinguish the abstract from the perceptible. In the theory there are two great contradictory entities, the chaotic material world, and the world of law and order (of Mind) beyond. These two, when conceived in the mind, coexist at rest next to each other. The perceptible world of *real* phenomena begins to take form when the contrast between these two entities finds its resolution through an ever-continuing process, a process in which order is continually imposed on the inherently *single* Existent Being.

Unfortunately Anaxagoras was not able to express these highly abstract ideas in appropriate language, but used only concrete expressions which led to misunderstanding. For example, phrases like "the predominant substance determines the nature of an object" gave rise to the impression that Anaxagoras held that there were many substances, and led to the mistaken association of a theory of homoeomeries with his name.

Anaxagoras' cosmogony is very good modern physics, inasmuch as it pictures the world emerging out of fiery gases.

H. BECKEL (8), *Anaxagoras' Theory of Living Things* (1868): Much of this is the standard account; the main concern of the author is to discuss Anaxagoras' biology and his theory of Mind.

A careful examination of the sources shows that Anaxagoras held that the seed of animals comes from aether and the seed of plants from air; air and aether together (as providers of seed) are the masculine factor, while earth and water (as providers of nourishment) are the feminine factor in procreation.

Anaxagoras did not investigate the nature of Mind in detail, since his theory of matter absorbed his attention much more (p. 36). He distinguished Mind carefully from matter, and though Mind seems to be a very fine and light kind of matter (p. 27), it is plainly incorporeal (p. 21). Mind rules the world through the intermediary of a rotational motion (*not* directly) (p. 22); animals and plants, on the other hand, are not moved externally but *internally* by Mind (p. 23). Unfortunately Anaxagoras did not make it clear how Mind, which is mixed with nothing, can be in animals. But we know that he thought Mind was in animals because animals are ordered entities capable of intelligence and understanding (p. 23 ff.)—rather than because they move, or have a certain proper size, or because they are capable of dissociating food into its nutritive components in the way that Mind dissociated the different kinds of matter initially. And it is also clear that there is no distinction between the cosmic Mind and the minds of living things, except one of size; and distinctions of size (i.e. of quantities of Mind) are responsible for the differences among living things (p. 26). The relation in the theory between the mind or intellect of an animal and the structure of the body is impossible to determine.

M. J. MONRAD (74), *Anaxagoras and Atomic Theory* (1870): This article is an attempt to place Anaxagoras in his proper place, chronologically, in the history of philosophy, in order to understand the influences which shaped the character of his system, and in order to gain insight into the laws governing the development of philosophical systems. Monrad relies heavily on Aristotle.

The main point is that Anaxagoras must not be placed after the atomists and his system must not be viewed as an attack on atomism, since in fact Anaxagoras preceded the atomists and his system is perfectly comprehensible on the basis of the physics which preceded him (e.g. Eleatic and Ionian physics); while much that the atomists teach (e.g. the void, blind chance, etc.) can be viewed as a polemic against Anaxagoras.

F. NIETZSCHE (77), *Ch. 6: Anaxagoras* (p. 64) (1873): This essay shows deep involvement on the part of the author, and real sympathy for Anaxagoras. Anaxagoras is viewed as having been primarily concerned with refuting the Eleatics.

All of Anaxagoras' infinite substances have one thing in common, which enables them to interact mechanically and physically by means of collisions and mutual forces: this thing is *matter*, the substratum of all the substances, which really differ from one another by virtue of the qualities attached to the matter they contain. The original chaotic mixture consisted of matter-filled points (sic!—"kleinen erfuellten Punkten"; p. 77) each of which bears *one* specific pure quality. Many of these points (called by Aristotle 'homoeomeries') possess the *same* quality, but originally these points were strewn about and completely and thoroughly intermingled (not just haphazardly thrown about).

Now since change and motion are real, Anaxagoras looked for a source of motion and change, since matter could not move itself. This led Anaxagoras to the abstract concept of Mind. However in order to avoid the physically meaningless picture of an *idea* imparting motion to *matter* (something which is completely incomprehensible from the point of view of mechanics) Anaxagoras had to give Mind a material substratum, calling Mind a very fine substance characterized by its special property, *Thought*. The action of Mind could then take place in the normal way, through mechanical impacts and forces. Unfortunately it must be admitted that this solution leaves Anaxagoras with the paradox of a substance which moves itself, i.e. something which is its own cause, so that the solution is not free from circularity. Mind-substance like all the others is indefinitely subdivisible, but every piece no matter how small is always bounded by other pieces of Mind, since Mind is never mixed with matter. It is not clear why Anaxagoras insisted on keeping Mind unmixed with matter, but he did; and he viewed Mind as ruling and moving matter purposefully according to its desires, freely and unhampered.

Mind's activity has an ultimate purpose in the theory—a purpose conceived of as being gradually attained—to separate the matter in the original mixture into aggregates of wholly pure matter. Once this is achieved, Mind will no longer cause matter to move, or to live (!); Mind will then leave the purified matter alone and simply go on moving itself. The great beauty in this picture is its total lack of anthropocentrism; man plays an insignificant role in the universe. Nor is there any taint of moral purpose in Mind's action: Mind works simply as an artisan.

Anaxagoras' cosmology is especially ingenious. Mind achieves its goal by means of rotational motion, which spreads outward radially. Initially Mind seized on a completely arbitrary point, chosen by the free will of Mind, and started its work with that point as center. As the rotation spreads it becomes progressively slower, so that the rate of spread and the rotation both decline indefinitely. It might appear that there would have had to have been an impossibly strong (i.e. fast) rotation initially; since in order for all existing rotation to have been concentrated at a point, it must have been infinitely fast. (Apparently Nietzsche is here applying some sort of law of conservation of angular momentum to Anaxagoras' theory.) To avoid such a physical absurdity we must imagine that originally *each and every point* in the universe was spinning around itself, so that the mass as a whole remained stationary; Mind's spreading influence can then be pictured as the progressive alignment of more and more spinning points in a single grand rotation about the arbitrarily selected initial point, each point in turn ceasing to spin about itself and spinning instead around the cosmic center.

A. EMMINGER (40), *The Presocratic Philosophers According to Aristotle's Account:* "Anaxagoras" (p. 75) (1878): Contrary to the impression given by the title, this book is not merely an exposition of Aristotle's account of Anaxagoras' doctrines. Emminger makes it clear in the introduction that Aristotle is full of misunderstandings and distortions; that it is lucky that we have so many fragments of the presocratics because these enable us to get a true picture of their theories and to extract *some* useful information from Aristotle; and that Aristotle's testimony is to be relied on only when he makes purely objective statements—which Emminger never defines, although from the material below it is clear that he considers very few of Aristotle's statements to be purely objective—or, to a lesser degree, where the fragments are silent and only post-Aristotelian (and hence even more worthless) testimony remains in addition to Aristotle.

Thus for example Aristotle's use of the term 'homoeomery' is misleading, since Anaxagoras did not take only pieces of homogeneous substances as his basic elements, but considered *all kinds of things* ("Dinge") to be basic, all of which were present in the original mixture. This part of Anaxagoras' theory was not thought out carefully; nor did he have a clear picture of the nature of qualities.

Aristotle also unfairly accuses Anaxagoras of denying the law of the excluded middle. (Sic! See sources 72, 74, for example.) Anaxagoras surely did not deny this law, though it is true that his theory would lead to a denial if carried to its logical conclusion (p. 82).

Aristotle and Plato are correct however in pointing out that Anaxagoras uses Mind only as the general source of order in the universe, and does not bring it into play in explanations of specific phenomena. As far as the theory of Mind is concerned, "Anaxagoras is like a fighter who gets in *one* good blow with the aid of much luck and little talent." ("Anaxagoras gleiche einen Fechter, der *einmal* gut trifft mit viel Glueck and wenig Kunst"; p. 80, cf. Aristotle *Metaphysica* 985a13–16.) Still, he probably deserves to be called the founder of the teleological point of view in natural philosophy.

W. DILTHEY (39), *Book 2, Part 2, Chap. 2: Anaxagoras and the Origin of Monotheistic Metaphysics in Europe* (p. 158) (1883): Anaxagoras was, according to the author, a great physicist who conducted many experiments. He was also the first to introduce monotheism to Western lands.

Anaxagoras used induction to apply terrestrial physics to celestial phenomena as well (p. 163 f.). It was thus that his study of astronomy led him to conceive of Mind. In particular, two specific things led him to this conception: (1) The need for a force to counteract the force of gravity and keep the massive heavenly bodies from falling to earth. This force—on the basis of terrestrial experience—had to be rotational (centrifugal), and could account for the rotation and the order in the heavens. (2) The need for a single unifying factor to explain why all the stars rotate together despite the fact that each rotates individually and each turns in a circle of different radius, varying from zero radius at the pole star to maximum radius at the celestial equator. Dilthey clearly does not think that Anaxagoras could have simply accepted as a fact that all the heavenly bodies rotate together (as if they were rigidly attached to a sphere whose axis of rotation passes through the pole star). The requirement then for a single force to initiate a rotation which causes all the heavenly bodies to move coherently in circles varying from a point to equatorial great circles led Anaxagoras to conceive of Mind, "a force totally independent of the substance of which that body [the heavens] is made, purposeful, and indeed functioning with intelligence," ("[eine] von der Materie dieser Koerper unabhaengige, zweckmaessig, sonach intelligent wirkende Kraft"; p. 165) which started the rotation of the heavens from a point (viz. the north celestial pole) and thence gradually extended the rotation outward in circles of ever-increasing radius.

G. UNGER (102), *The Chronology of Anaxagoras and Empedocles* (1883): This is a major effort, filled with polemics, to establish an early dating for Anaxagoras (533–462 B.C.E.) and for Empedocles. Unger brings all kinds of evidence, such as the argument (from the silence of Plato) that Socrates did not know Anaxagoras; the tradition that Anaximenes taught Anaxagoras; and much else. He launches a violent attack on the Alexandrian chronologers for getting everything all mixed up. His argument involves the redating of a number of other figures in addition to Empedocles and Anaxagoras.

P. TANNERY (98), *Ch. 12: Anaxagoras* (p. 284) (1930; the material presented here first appeared in 1888 and in the years following): Tannery thinks that Anaxagoras was a poor scientist, and that his real contribution was in the field of philosophy: "The services which he rendered science were second-rate and do not reach the level of his philosophical contributions" ("les services qu'il a rendus à la science sont d'ordre secondaire et ne s'élèvent nullement à la hauteur de son rôle philosophique"; p. 289). Indeed Anaxagoras is well-known for having introduced the distinction between matter and spirit.

Tannery analyzes the reason Anaxagoras was led to his theory of Mind. With the introduction of the concept of an infinite universe it was no longer possible to endow matter with the inherent property of being able to move and rotate; for an infinitely large universe can not rotate. Anaxagoras solved the problem of the rotation of the heavens by introducing a source of rotation exterior to matter.

Tannery's explanation of Anaxagoras' theory of matter is essentially a development of Nietzsche's description (*q.v.*). According to Tannery, Anaxagoras accepted the monistic Milesian conception of a single fundamental kind of matter: *all* matter is the same, no matter how you divide it. And matter is continuous, so that any arbitrary subdivision of matter has the same composition as any other subdivision. What distinguishes one thing from another is the qualities attached to the material substance. At each point in space (where by 'point' is meant a small volume taken in the limit as it approaches zero—an obvious attempt to clothe Nietzsche's 'matter-filled points' with mathematical respectability) there is a well-defined amount of each of the basic set of primary qualities which modify matter. The amount of each quality present varies from point to point, but in any given body the sum total of all the qualities integrated over the body determines the appearance of the body (p. 295)—though Anaxagoras did not of course draw all the conclusions he might have had he known calculus (p. 296). Thus Anaxagoras' 'elements' are "qualities inherent in matter, but variable in degree from one body to another" ("qualités inhérentes à la matière, mais variable en degré d'un corps à l'autre"; p. 296), though he left open the question of just how many qualities are primary.

We see then that for Anaxagoras fire contains all the same 'elements' (i.e. qualities) as bone and flesh, but in different degree; "but to say with Aristotle that fire is composed of homoeomerous particles, like those of flesh and bone, is evidently a gross distortion of the Clazomenian's thought" ("mais dire avec Aristote que le feu est constitué de particules homoéoméres, semblable à celles de la chair ou des os, c'est évidemment défigurer du tout au tout la pensée du Clazoménien"; p. 296). Aristotle, in short, completely misunderstood the theory, as we can easily see by comparing his account with the fragments. True, Anaxagoras speaks of *spermata* (seeds) as forming macroscopic bodies, and these seeds really *appear* to be different kinds of matter; this is what led Aristotle astray. Indeed it may even be that Anaxagoras spoke of these 'seeds' in a loose, non-rigorous manner, giving rise to the impression (which misled Aristotle and others) that matter was composed of different kinds of matter. But in fact the 'seeds' are just as decomposable and divisible as macroscopic bodies, and they are not, therefore, Anaxagoras' 'elementary building blocks of matter'.

Tannery finds two major defects in the theory: (1) Anaxagoras considered *both* of a pair of contrasting qualities to be elementary—

as did all the other early thinkers—rather than taking one of them to be elementary and allowing that one to vary in degree or intensity (and so to give rise to the other, as well as all intermediate degrees). (2) Anaxagoras held that qualitative change could take place only by the mechanical displacement of the matter substratum to which the qualities are attached, i.e. only by actual rearrangement of matter. Both errors arose from Anaxagoras' inability to make a clear distinction between matter and quality, which would have permitted him to hold that matter serves as a substratum for qualities which can freely vary. But the distinction was almost there, and it was soon added by Anaxagoras' successors. Indeed, by focusing on the qualities present in a body, Anaxagoras comes within a step of Plato's theory of Ideas (p. 301); and Anaxagoras provides the perfect answer to Zeno, showing that unity and plurality can coexist as unity of matter and plurality of attributes.

Tannery takes Aristotle severely to task (pp. 302 ff.) for distorting Anaxagoras' theory and for other things as well, e.g. for calling the Pythagoreans rather than Anaxagoras the forerunners of Plato. He ends with a paean of praise for Anaxagoras and with the hope that Anaxagoras' brilliant conception of matter, the best of all the conceptions and one which has sadly been forgotten, will be revived and will replace the current picture of matter employed by physicists.

P. DECHARME (32), *Euripides and Anaxagoras* (1889): This is one of many discussions of the relationship reported by many ancient authors between Anaxagoras and the 'philosopher-playwright'; but it is one of few that seek to show that this entire tradition is without foundation in fact. Decharme analyzes the testimonies one by one, undaunted by the large number of witnesses he must dispose of. Though the book is coldly analytic, its conclusions have not met with general acceptance.

S. FIMIANI (43), *Some Observations on the Relation Between Mind and Life in Anaxagoras' Philosophy* (1889): In this study Anaxagoras is viewed as the originator of subjectivism, the one who introduced the "I" into philosophy. Anaxagoras begins with *himself*, with a look into his own soul, where he finds the incorporeal, thinking intelligence which is distributed in all living beings; only after this introspection does he proceed to work upward towards the concept of a universal Mind which causes everything that goes on in the whole world. This Mind is just short of being an impersonal moving force; it is an incorporeal primordial substance (totally different from matter) which is nevertheless not yet a 'natural force', as we understand it, that cannot really be divorced from matter. (In Anaxagoras we see the more advanced concepts in their embryonic development.) But the important thing to realize is that Anaxagoras did not start from Olympus or from the chaos, but from *himself*.

Thus individual manifestations of life, individual souls, are radically different in nature from the cosmic Mind: "Mind and soul in Anaxagoras' theory, far from being identical, represent two extremes of the same process—the one transcendent, the other immanent; the one spiritual, the other attached to matter" (". . . intelligenza ed anima, in Anassagora, lungi dall'essere identiche, rappresentano due punti estremi ed opposti d'un medesimo processo, l'uno trascendente, l'altro immanente, l'uno spirituale, l'altro corporeo"). True, Aristotle seems to say that the two are identical for Anaxagoras, but a close reading of Aristotle shows that in fact he wavers. We can probably ascribe Aristotle's attempt to identify Mind and life as a desire to free Anaxagoras of the inconsistency inherent in positing life as a motive force different from Mind in a theory which is purely dualistic, and which therefore should be expected to contain only *one* entity different from matter.

Fimiani feels that his analysis enables us to understand better Anaxagoras' theory of perception and knowledge; for the basic difference between the individual perceiving Soul and the supernatural, sovereign Mind is similar to the distinction between sense perception and spiritual activity.

M. HEINZE (58), *On Anaxagoras' Mind,* (1890): Heinze's main point is that Anaxagoras' Mind, which was conceived under the influence of various earlier similar conceptions, is a wholly incorporeal entity. The article is a detailed discussion of the characteristics of Mind, including demonstrations that the predicates applied to Mind in the ancient sources, which seem to endow Mind with material properties, in fact do not. Thus for example Heinze argues (p. 14) that 'infinite' when applied to Mind has a metaphorical meaning, and really signifies the negation of extension, i.e. Mind's boundless power. Heinze also seeks to refute in detail the arguments of others who hold that Mind is material. He interprets Plato and Theophrastus as saying that Mind is incorporeal, and he considers that their evidence, together with the clear evidence of Aristotle's testimony, is sufficient to assure that his view is correct.

Heinze believes that Anaxagoras resembles Descartes as a thinker in many respects. He finds it difficult to say with assurance whether Anaxagoras was a pantheist.

Anaxagoras confused Mind and Soul, so that from one point of view Mind was kept apart from the world (governing the world in some unexplained way) but from another point of view Mind was very much in the world, in living beings.

J. BURNET (15), *Ch. 6: Anaxagoras of Klazomenai* (p. 272) (1892): Much of the account given here is standard, but Burnet always reserves to himself the freedom of rejecting one or another of the standard sources on various grounds. The Origen(Hippolytus?) account (source 271) is taken as the chief source for Anaxagoras' particular theories.

Basically Burnet accepts Tannery's interpretation of the theory of matter (*q.v.*). The 'things' which Anaxagoras refers to are the pairs of contrasting qualities (the 'opposites'), so that the statement that there is something of everything in everything is equivalent to the statement that everything contains all the 'opposites' at least to some extent. Burnet then goes on to say that there are molecular entities in the theory—to which Aristotle justly applied the name 'homoeomeries'—and that these are the 'seeds' of which material objects are made up. The 'seeds', then, are nothing else than pieces of matter containing the "primary combination of the . . . opposite qualities" (p. 289). These molecular pieces can be subdivided indefinitely and they were actually present in the original chaos in infinitely small pieces. (The theory of Tannery as modified by Burnet has gained wide currency as the Tannery-Burnet theory, especially among scholars who write in English.)

According to Burnet, Anaxagoras believed along with others among his Milesian predecessors that there are innumerable worlds. Mind for him was material, and the concept did not represent much of an advance over earlier theories. But Burnet applauds Anaxagoras for saying that sensation depends on "irritation by opposites."

W. WINDELBAND (108), *Ch. 22: Anaxagoras* (p. 80) (1901^2, first edition 1892): This work contains a standard account. Windelband notes that Aristotle, when speaking of the substances regarded as fundamental in Anaxagoras' theory, refers only to organic substances; but the author hastens to assure us that this reflects Aristotle's own predilection rather than any distinction made by Anaxagoras between the organic and the inorganic (p. 81). Mind too is a substance, a "primitive dynamic material or motion-stuff . . . It moves the others [i.e. the other substances] from within itself" (p. 82). It has, in fact, "all the functions of the Heraclitean fire."

E. WELLMANN (107), *Anaxagoras* (in Pauly-Wissowa) (1894): The account given in this article is standard. Wellmann considers Anaxagoras to be the first dualist. He adopts Dilthey's description (*q.v.*) of the cosmic rotation initiated by Mind.

E. ARLETH (2), *Anaxagoras' Theory of Mind and Soul* (1895): Arleth leans rather heavily on Aristotle's testimony (see esp. p. 67 ff.). The article begins with a review of the views of the author's predecessors concerning the nature of Mind. Arleth himself makes a strong case for the view that Mind is incorporeal. Like Heinze, he tries to demonstrate in detail that all of the seemingly material predicates applied to Mind can easily be understood as applicable to an incorporeal entity. For example, Mind is called the most penetrating of all things. However, if Mind were material, its ability to penetrate other things would stand in blatant contradiction to its oft-mentioned attribute of not being mixed with matter at all; therefore this ability is clearly not to be taken in the sense of a property of something material. In the same way, 'larger' or 'smaller' when applied to Mind could mean, according to Arleth, 'more talented' or 'less talented', rather than 'larger in volume' or 'smaller in volume'. Arleth brings supporting evidence for these and similar views, and concludes his article (p. 85) with a fine summary of Mind's properties.

Arleth succeeds—and he is the only one to do so—where Tiedemann (*q.v.*) fails, in understanding the relationship between the nature of Mind and Anaxagoras' theory of perception (p. 76 ff.); for he is aware that Anaxagoras held that perception occurs via the interaction of things having different properties. Arleth sees that it follows from this that Mind is free from all admixture of matter, and is indeed totally different from all matter, because Mind is omniscient and perceives and knows all things with perfect precision; for the theory of perception requires that something which knows everything must be entirely different from everything.

C. GIUSSANI (50), *Excursus III (on Book I, lines 830–920, concerning Anaxagoras)* (Vol. 2, p. 147) (1896): According to Giussani, Anaxagoras' theory of homoeomeries is an expression of the continuity of matter, based on a hypothetical construction. Anaxagoras is saying that *if* we had a piece of pure gold, any subdivision of this piece would also be pure gold. In fact however no material body is pure; rather all bodies contain hidden in them infinitesimal particles of all substances, of which we perceive only the predominant component. And "the basic substances themselves are essentially pure quality, that is to say, qualitative forces . . ." ("gli elementi per lui sono essenzialmente della qualità, come a dire delle forze qualitative . . .").

The real problem, according to Giussani, is to understand how Anaxagoras' theory accounts for physical change. Giussani rejects the standard explanation that change occurs by the accretion or removal of certain particles, since there would be no reason for Anaxagoras to insist that all things are in all things in order to account for physical transformation, if he explains physical change by the addition or subtraction of matter outside the body undergoing change. (This amusing objection disappears when the standard explanation is stated correctly: In Anaxagoras' theory physical change occurs when the delicate equilibrium in the mixture which makes up any given body is disturbed by the addition or subtraction of a *small amount* of matter so that the predominant component in the body changes, and not when the matter composing most of the body is displaced. If the body did not already have all things in it physical change could never occur by the displacement of less than half the amount of matter in any given object.)

Giussani's solution rests on the infinitesimal nature of the elementary particles in Anaxagoras' theory. There are in any object an infinite number of infinitesimal particles representing each of the infinite kinds of substance. Since this means that there are the same number of particles of one substance as there are of another in any object, the only thing that can possibly distinguish one object from another is the state of *aggregation* of the infinitesimal particles in the object: that type of matter whose particles are joined together in *bunches*, in little collected *chunks*, come to view and lend the object its characteristics. All the other kinds of particles in the object, since they are not grouped together but are strewn about in imperceptibly small infinitesimal amounts, are not perceived. Physical change and transformation occurs then by the simple mechanism of breaking the clusters of one type of matter and forming clusters of other types of matter, this being the process of dissociation and recombination of which Anaxagoras speaks. The new clusters then 'predominate' in the object, and the object is said to have undergone change. Thus for example a glass of milk turns into blood when clusters of infinitesimal milk particles break up and clusters of blood particles form in their place.

There is not a shred of evidence to support this ingenious theory.

T. GOMPERZ (52), *Vol. I, Book II, Ch. 4: Anaxagoras* (p. 208) (1901; first appeared in 1896): Gomperz does not like Anaxagoras, and attacks him violently—and it must be admitted rather vulgarly—in a long tirade (pp. 224–226). He takes Anaxagoras to task for his "patriarchal dogmatism," his pronouncement of "the wildest paradoxes . . . in tones of the calmest infallibility" (sic!). Gomperz thinks he talked "with the confidence of revelation," "undisturbed by doubts"; that he had "no taste or understanding for dialectic discussion"; and that his "arid teachings" were "unillumined by a spark of poetry or humour." Although Gomperz considers Anaxagoras to be most unscientific in that "his system was based on the unconditional belief in the testimony of the senses" (p. 209; Gomperz holds that Anaxagoras was in no way influenced by the Eleatics), he attacks him as well for his "virtual indifference to the justification by fact of his finely wrought hypotheses." It is impossible to ascertain the origin of, or the real reason for this outburst of Gomperz'.

According to Gomperz Anaxagoras considered organic substances to be elementary, and inorganic matter to be composite. (Gomperz attacks this for being the reverse of the truth; he hardly lets an opportunity slip for ridiculing Anaxagoras' views.)

Anaxagoras did not explain just *how* a change in the state of aggregation leads to a change in the appearance of an object, although Anaxagoras did try to reduce all change to mechanical displacement of imperceptible pieces of matter. It was in this connection that Anaxagoras performed his famous experiments: "to minimize the disbelief in the reality of the invisible in general, he quoted the example of the invisible air imprisoned in an inflated bag, and the resistance it offers to our endeavours to compress it" (p. 213). Gomperz is unique in this view of the purpose for which the experiments were performed.

Anaxagoras believed that the same physical laws apply throughout the universe; thus rotational motion is necessary to keep the stars up, since they too like all other heavy bodies display a natural tendency to fall. The rotation was also employed in the cosmogony, but there its purpose was to *shake up* the initial mixture of matter, until "the friction of the particles was overcome, and they were enabled to follow the bias of their specific gravity" (p. 215). This too is an original interpretation on the part of the author, contradicting the ancient testimony.

Without explaining why, Gomperz states that the picture of an earth supported by the air beneath it is incompatible with the picture of stars which go under the earth in their daily rotation. As for the explanation of the Milky Way, Gomperz feels that "Anaxagoras was probably a little exorbitant in his demands on the symmetry of cosmic phenomena" (p. 221).

E. DENTLER (34), *The Fundamentals of Anaxagoras' Philosophy* (1897): This monograph is a discussion only of Anaxagoras' theory of matter and Mind. The fundamental constituents of matter in Anaxagoras' theory were *things* ("Dinge"), having all the observed qualities permanently inherent in them; Dentler agrees with Windelband *(q.v.)* that Aristotle's restriction of the examples he gives of elementary substances in Anaxagoras' theory to organic materials in no way implies a corresponding restriction on the part of Anaxagoras.

Dentler attempts to refute Tannery at length (p. 15 ff.); and he gives a long, interesting, and detailed analysis of the use of the term 'homoeomery' (p. 18 ff.), concluding that it is a later Aristotelian term which was, however, applied correctly to Anaxagoras' theory.

According to Dentler, the fact that matter taken by itself is always mixed and stationary led Anaxagoras to his dualistic concept of a cosmic Mind which imparted motion to matter and sorted out the mixture.

6. The First Half of the Twentieth Century

J. I. BEARE (7), *Greek Theories of Elementary Cognition* (1906): This book contains an account of Anaxagoras' theory of perception, based almost entirely on Beare's interpretation of Theophrastus (esp. source 87). Thus for example Beare tells us that Anaxagoras based his theory that sensation is accompanied by irritation or pain on the observation of "the effects of time and age in dulling the senses," as well as on the effects of intense and prolonged stimuli (p. 208); that according to Theophrastus Anaxagoras "has not left on record his views of the more corporeal senses" (p. 184); and that Anaxagoras held that black is the color of water (see source 102) and white the color of fire (sic!–p. 65). Beare is displeased with Anaxagoras' failure to explain *how* we come to know through the senses (p. 208).

A. RIVAUD (88), *The Problem of Coming-To-Be and the Concept of Matter in Greek Philosophy* (Sections 126–131, p. 189) (1906): According to Rivaud, the basic problem in reconstructing Anaxagoras' theory of matter is the presence of two contradictory groups of testimonies, one stressing *particles* ('homoeomeries', 'seeds') as the basic building blocks of matter, the other stressing *things* (*chrēmata*, such as blackness, whiteness, flesh, bone, etc.—sic!) and making no mention of particles. Correspondingly, says the author, there have been two interpretations in modern times, one describing Anaxagoras' theory as a particle theory of matter (e.g. the standard account), and the other describing it as a theory in which qualities play the major role (e.g. Tannery, *q.v.*). Rivaud proposes a new compromise solution, which is essentially a clear formulation of the solution implied by Burnet: Anaxagoras' theory contains both particles *and* qualities. The qualities are the basic elements of the theory—pairs of contrasting qualities, coupled two by two and moving about eternally. Along with these qualities, however, there appear particles made up of the qualities, which are distinguished from one another by different proportions of component qualities. The qualities are indefinitely divisible and form the ultimate foundation of all things in the universe; through their presence all things are inextricably mixed with one another, and through them each thing contains something of all other things, by virtue of having in it the same ingredients as all other things. The particles, on the other hand, are relatively stable configurations of qualities; their existence explains the presence in the world around us of relatively stable objects and quality-complexes amidst the ever-changing flux of the basic qualities. The particles are "momentary standstills, temporary halts in the unceasing process of change which involves the pairs of contrasting qualities" ("Ce sont des arrêts momentariés, des haltes provisoires dans le devenir incessant qui entraîne les qualités contraires"; p. 195). We have here a sort of temporary atomism which enables the theory to enjoy the advantages of permanence and definiteness present in an atomic theory side by side with the ability to account for change and coming-to-be present in a theory of qualities in flux.

Thus in the theory change may occur in two different ways: one way is a simple, superficial rearrangement of the particles; the second way is more far-reaching, and consists of a complete qualitative transmutation, a basic change of attributes which substitutes one form of reality for another. Anaxagoras emerges then as the real father of alchemy: "no transformation, no matter how incredible, is excluded: there is absolutely no limit to the fecundity of Nature . . . Living Nature is infinitely fertile" ("Aucune transformation, la plus incroyable même, n'est exclue: il n'y a point de limites, à la fécondité de la nature . . . La vie de la nature est infiniment féconde"; p. 197).

Rivaud thinks that Mind in the theory is neither corporeal nor incorporeal, since the real distinction Anaxagoras draws is not between Mind and matter, but between Mind and chaos (taken as an abstract concept, not necessarily as a mixture of different kinds of matter). Mind represents order and motion (the two things that Life represented for the ancients), and Simplicius has correctly understood the contrast between Mind and the mixture to be essentially the contrast between the world of conceived forms and the world of perceptible coming-to-be.

C. BAKEWELL (5), *Ch. 6: Anaxagoras* (p. 49) (1907): Bakewell's book is an English translation of the so-called fragments of the presocratics, of excerpts from later philosophers, and of some of the standard ancient accounts of the doctrines of these philosophers. He makes an attempt to translate into English considered modern at the turn of the century.

G. ZUCCANTE (113), *Anaxagoras* (1908): This is essentially a review article containing the standard account.

Zuccante considers Mind to be incorporeal, though Anaxagoras did not always make this clear, due to the inadequacy of the Greek language in his day. Though it often seems that Anaxagoras talks of Mind as a fine, subtle substance, "the philosopher's intention is obviously different; he seeks to contrast the mixed with the unmixed, the composite with the simple, the corporeal with the incorporeal" ("l'intenzione del filosofo è diversa, evidentemente; egli vuole contraporre al misto l'immisto, al composto il semplice, al corporeo l'incorporeo"; p. 627).

W. WALLACE and J. M. MITCHELL (106), *Anaxagoras* (Eleventh Ed. Britannica, Vol. I, p. 943) (1910): This is a standard account, despite the statement that "it is difficult to present the cosmical theory of Anaxagoras in an intelligible scheme." The authors view Anaxagoras' chief contribution as the introduction of the concept of reason in the world, a conception which passed from him to Aristotle, and thence to the commentators, and which became a flourishing subject of speculation under Averroes' influence.

W. HEIDEL (54), *A Study of the Conception of Nature among the Pre-Socratics* (1910): This is a general study of the early Greek concept of nature and of natural law. There is a detailed philological study of the word *physis*, among others.

Heidel denies that any of the presocratics (Anaxagoras included) used teleological laws in his natural philosophy.

W. HEIDEL (55), *Antecedents of Greek Corpuscular Theories* (1911): This is a study of the origins of corpuscular theory. According to Heidel these origins "lie in the dateless age before the birth of history" (p. 171). His favorite source is Lucretius; of Aristotle he is suspicious, since Aristotle so often misrepresents the theories of others (p. 111) and even exterted a bad influence on his pupil, "honest Theophrastus" (p. 112).

Heidel views Anaxagoras' theory of matter as very similar to the theories of the atomists, and thinks there is no doubt "that at the root of his system lies the primitive (sic) conception of qualities as concrete substances" (p. 158). In fact Anaxagoras in general had a kind of "primitive man's conception of nature" *(loc. cit.)*.

As for Mind, Anaxagoras "clearly held the doctrine of cosmic respiration, for therein he finds the Nous, by which all within the world is ordered . . . Nous is in short like the 'soul', which enters and leaves the organism with the breath" (p. 138). This remarkable conception is based on Heidel's interpretation of the meaning of Simplicius *In Phys.* 157.7–9.

W. SCHULTZ (96), *The Text and the Immediate Context of Fragment 20 of Anaxagoras* (1911): This is a study of that part of the Hebrew translation of Galen's commentary on Hippocrates (and of the extant Latin translation of the Hebrew) which appears in Diels-Kranz' collection (37) as fragment 20. The article gives some insight into the methods used to identify so-called fragments. Especially interesting is p. 337 ff. where an admittedly corrupt Hebrew transcription is identified with the name of Anaxagoras.

F. M. CORNFORD (27), *From Religion to Philosophy* (p. 153 ff.) (1912): Here Cornford concerns himself solely with Anaxagoras' concept of Mind. (For Cornford's analysis of the theory of matter see below.) He views Mind as a soul-substance or "animate fluid" permeating matter and moving it. This substance is essentially intellectual; "it is nothing but the scientific intellect itself, which has taken the world to pieces (sic!), and now is projected to the further end, and charged with the task of sorting out the heap, and reducing it again to order" (p. 154). "Nous *constitutes* the world, as the scientific intellect constitutes its representation of it, by introducing distinctions and discriminations" (p. 153, Note 1).

Cornford finds that Anaxagoras' merit lies in making little use of Mind in his theory beyond its function as the initiator of mechanical motion which, once started, goes on largely without Mind's aid.

T. HEATH (53), *Ch. 10: Anaxagoras* (p. 78) (1913): This is a standard account of Anaxagoras' reported contributions to astronomy, which on the whole Heath views as little better than the theories of the earlier Ionians. The account leans heavily on Origen(Hippolytus?) (source 271).

Heath thinks that Anaxagoras' theory of the phases of the moon could hardly have been correct since Anaxagoras "doubtless" held that the moon and the other heavenly bodies were flat, just like the earth (p. 80). Still, Anaxagoras' greatest contribution to astronomy was his realization that moonlight is the reflected light of the sun.

Another interesting advance made by Anaxagoras is the distinction drawn between vortical forces which concentrate heavy bodies at the center, and centrifugal forces which, as in the theories of Kant and Laplace, tear stones away from the earth and turn them into heavenly bodies.

Anaxagoras believed that there are many worlds, according to Heath.

A. MIELI (72), *The Theory of Matter in Presocratic Greek Philosophy; Part Two: Anaxagoras and the Atomists* (1913): Mieli is grieved that since the time of Aristotle's completely erroneous account, no one has understood Anaxagoras' theory, nor has the theory exerted any influence on Anaxagoras' successors. This is the more to be lamented since the theory *might* afford an alternative approach to present day (1913) chemistry (see the next entry below). Mieli protests however that he does not want to supplant the current theory but only to demonstrate how useful is the study of history.

Mieli says that his account follows Tannery (*q.v.*), though his version is totally different. He pictures Anaxagoras as saying that there are different basic *substances* or *materials* which are all continuously distributed throughout space, all interpenetrating, since each of them occupies all space; the quantity of *each substance* at each point of space is a function of position and time. Mieli points out that in modern terms, this would be expressed as $m_p = \phi_p(xyzt)$ where ϕ is a continuous function, and m_p is the amount of substance p at point (xyz) at time t. The total amount of each substance remains constant, i.e. $d/dt \int \phi_p dxdydz = 0$; the substances are eternal and can not change into one another. At each point the predominant substance comes into view and thus determines the perceived world. As for change, this occurs when the external force, Mind, brings about changes in the distribution of matter.

It is not clear to Mieli whether in the theory any particular property of matter remained constant at a given point; it is not clear to him whether Anaxagoras considered the question at all.

A. MIELI (73), *Anaxagoras' Theory and Modern Chemistry (The Development and Utilization of an Ancient Theory)* (1913): This article is an expansion of points hinted at in the preceding article (see directly above). The usefulness of the study of the history of ideas is demonstrated by showing how Anaxagoras' theory, with but small modifications, can serve as a guide today.

Mieli described Anaxagoras' theory of matter in the preceding article, where he gave a version which he ascribed to Tannery, but which in fact differs from Tannery's. He here proceeds to suggest a slight modification in the "Tannery interpretation" above, to make the theory useful—and the modification does nothing more than bring Mieli's account of the theory into agreement with Tannery's actual account! Mieli suggests as his innovation the substitution of 'qualities' for 'substances' in the statement that a basic set of substances appears in varying amounts (in a continuous distribution) at different points in space, and that the proportion of substances present at each point determines the appearance of that point. Having made this substitution, he finds that the theory might serve as a useful alternative to present-day chemistry.

A. COVOTTI (29), *The 'Physicist Par Excellence' of the Fifth Century: Anaxagoras of Clazomenae* (1915): This is a standard account. The author is very excited about Anaxagoras' greatness, and thinks that Anaxagoras' major contribution was to provide a refutation of the theories of Melissus of Samos.

E. BIGNONE (9), *The Theory of Weight Held by Empedocles and Anaxagoras* (1917): This is a specialized article which seeks to show that when Aristotle says that Empedocles and Anaxagoras did not distinguish light from heavy, he means that they did not provide rigorous scientific theories of weight. For we know, for example from Theophrastus, that these thinkers did assign different weight densities to their various substances; but we also know, adds Bignone, that they frequently pictured their light elements as falling all of a sudden, in a most unscientific manner.

A. E. TAYLOR (99), *On the Date of the Trial of Anaxagoras* (1917): This article seeks to establish a chronology for Anaxagoras' life, based on an evaluation of the standard collection of sources. The overall chronology resembles the one we have adopted. One of the arguments for Anaxagoras' early departure from Athens (around 450 B.C.E.) and arrival at Lampsacus is that ". . . there was an unusually flourishing body of 'philosophers' at Lampsacus in the early years of the third century, and it seems . . . natural to suppose that this is explained by the activity of Anaxagoras there" (p. 87) (one hundred and fifty years earlier; Taylor explains that for Anaxagoras' influence to have been so profound that he was responsible for such lively activity so much later, he must have been at Lampsacus a long time . . .).

Taylor apologizes for writing so much on an unimportant error in chronology made by his predecessors by pointing out that many such errors add up to a considerable mess, for ". . . there are a good many similar cases. The history of scientific thought will never be rightly written, even in its main outlines, until we learn that a thing is none the more certain because it has been pronounced *allgemein bekannt* by a chorus of *Herren Professoren.*"

W. CAPELLE (17), *Anaxagoras* (1919); (18), *Anaxagoras* (p. 112) (1953): Capelle gives for the most part an extended standard account. He views Anaxagoras as a step backward—towards Eleaticism—in the history of thought; his theories preserve the naivetés of the theories of his predecessors, and were much more primitive than those of his contemporaries. As a scientist he was second-rate, a poor observer with no significant scientific theory to his credit (the theory of homoeomeries being nonsense), whose only contributions of worth were in the field of meteorology (where, for example, he held that the sun was the ultimate origin of all meteorological phenomena—sic!, (18) p. 114); nevertheless, as a philosopher he was of considerable importance.

Anaxagoras' theory of matter held that matter is composed of truly infinitesimal pieces of *all* substances, one of which predominates in every given piece of matter. *All* substances are found in all pieces of matter, no matter how small. Though this would seem to imply, due to Anaxagoras' broad, imprecise phrasing, that even the infinitesimal particles had all substances in them, such is not in fact the case, since the particles are elementary. (See CLEMENS and ZEVORT above.) In Anaxagoras' theory bodies were formed by juxtaposition of particles; there was absolutely no concept of a chemical compound, a fact which made it necessary for Anaxagoras to assume as elementary *all* substances perceived in the world.

Mind is clearly incorporeal—which makes Anaxagoras the first dualist. The introduction of Mind is a major contribution, the first step towards the development of a teleological world view, even though the concept underwent no important development at Anaxagoras' hands.

Living beings vary in intelligence both because of their physiological structure and because of the different amounts of Mind which are in them.

W. CAPELLE (19), *The Presocratics* (1953): This is a translation of the standard collection of sources and the so-called fragments, all taken from DIELS (37), but arranged in different order and printed in an avant-garde format. In the preface, written in Germany in 1935, Capelle acknowledges the fact that scholars of all nations, even the United States, have contributed to presocratic studies, but concludes that the palm of excellence must go to "the German masters Eduard Zeller and Hermann Diels" ("den deutschen Meistern Eduard Zeller und Hermann Diels").

K. KUIPER (65), *On Anaxagoras' Mind* (1919): Kuiper feels that there would be little controversy about the nature of Mind if only Heinze's article (*q.v.*) were read: Mind is clearly incorporeal. Kuiper discusses at length the forerunners and predecessors of Anaxagoras' Mind, and thinks that Anaxagoras was attempting to refute the opinions of Thales and Heraclitus.

W. T. STACE (97), *Ch. 8: Anaxagoras* (p. 94) (1953; reprinting of 1920 first ed.): This contains a standard account of Anaxagoras' theories. Stace thinks highly of Aristotle as a source (compare such statements as: "Aristotle, as usual, puts the matter in a nutshell"; p. 105) and prefers him, apparently on chronological grounds.

As for Mind, Stace concludes that it was incorporeal: "Aristotle, who was in a position to know more of the matter than any modern scholar, clearly implies in his criticism that the Nous of Anaxagoras is . . . incorporeal . . ." There follows a long polemic against Burnet, containing arguments like those used by Heinze and Arleth (*qq.v.*). For example, the predicates 'greater' and 'smaller' when applied to Mind need not refer to spatial extension, but to degree; Stace then adds that even if the idea of spatial extension was intended, this would not mean that Mind was considered to be material since "the doctrine of the non-spatiality of mind is a modern doctrine, never fully developed till the time of Descartes" (p. 100).

Anaxagoras owes his importance to the fact that he introduced the concepts of Mind and of teleology into philosophy (compare CAPELLE—and HEIDEL!). But his dualism is irreconcilable (see RITTER), and his teleology turns out to be "only a new theory of mechanism" (p. 105).

J. LUDVIKOVSKY (67), *Studies in Anaxagoras' Theory of Matter* (1922): The author considers Lucretius to be a more reliable source than Aristotle (who often uses terms and concepts foreign to Anaxagoras) or Cicero. He thinks that Anaxagoras' greatness was due to the fact that he provided a reply to Eleaticism, which had exerted a terrible influence on philosophical thought; Anaxagoras talked about the real world, not about Being. Indeed Anaxagoras was primarily a scientist rather than a philosopher, and his main interest was meteorology. Much of Ludvíkovsky's account is standard.

Anaxagoras held that the senses are unreliable in quantitative matters, since there are things which are too small for the senses to perceive, and which we must assume to exist purely on theoretical grounds. However, in qualitative matters the senses are completely reliable, and all qualities perceived by the senses really exist.

According to the author, Anaxagoras held that anything divisible into an infinite number of subdivisions is itself infinitely large. Thus Anaxagoras would have considered anything built out of the atoms of Democritus to be infinite (p. 170), and there was for this reason no trace of atomism in Anaxagoras' theory: the *spermata* (seeds) he refers to are seeds in the ordinary meaning of the term, actual seeds from which living things grow (p. 165).

A. L. PECK (79), *Anaxagoras and the Parts* (1926): This is the first of Peck's articles on Anaxagoras, and the conclusions reached here were partially revised in his later work (see below). Peck begins with the statement, "The great number of contradictory statements which confront us when we examine the various explanations of Anaxagoras' philosophy make it more than usually important to decide what is to be admitted as first-hand evidence and what is not," and concludes that everything that "later" writers have said must be rejected in favor of the fragments, which must be understood in their proper historical setting. Anaxagoras was the official representative of Anaximenes in matters relating to cosmology, but his true contribution was in physiology: "in him . . . 'the physiological interest has definitely replaced the meteorological' ".

The theory of matter involves three basic things: the 'opposites'—a relic of the older philosophy; the 'four elements'; and the 'seeds' (*spermata*) or 'parts' (where Peck takes *moira*, 'part', to be a technical term in the theory). The four 'elements' are haphazard mixtures containing all the Seeds; they are indeterminate (the meaning assigned by Peck to *apeira*). The behavior of the Seeds was deduced by analogy to ordinary living seeds: ordinary seeds grow not by the addition of other seeds, but by "natural and organic development." So too the Seeds of Anaxagoras' theory; indeed their very name reflects their nature: " 'Seed' suggests a principle of organic growth." What happens is that Mind gives "the Seeds power to grow, and in that way to get large enough to be seen"; the food for the growth, the nourishment for the Seeds, is nothing other than the Opposites, and "we may suppose that different Seeds needed different quantities of the 'Opposites' ". Thus the Opposites correspond to the Elements, but they alone "would be insignificant, because they are not sufficient to produce sensible phenomena"; rather, seeds too are necessary in the theory.

Now all things have all seeds in them, but in any one object only one seed is "in power" (*kratei*). Change occurs when Mind decrees that another seed gain power and grow. Thus Mind is in direct control of all change, decreeing that now one thing, now another, have power. "It seems, in fact, to be the power of Mind *in* the organic things . . . that makes it possible for change to take place." The Seeds or Parts were themselves probably of organic substances, which display a high degree of organization, rather than of inorganic substances which are essentially random mixtures. These Seeds account for "sensible phenomena, subject to Becoming and Change." They are collected into little packets or collections of seeds, which are *indivisible*, and cannot be split even with a hatchet. These collections, "each of which contains a *meros* of every sensible phenomenon, ready to develop in favourable conditions," under the guidance of Mind, were called by Anaxagoras *homoiomereiai*. For example, a *homoiomereia* of bread becomes bone by going to that place where bone predominates and turning into bone when the Part of bone develops (where the Part of bread had previously been in control).

The cosmology in Anaxagoras' theory operates on different principles. Here there is no trace of homoeomeries, since "the doctrine of Similar Parts applies only to" physiology. In fact the cosmological fragments that "seem to indicate" separation of opposites in the initial stages of creation "unmistakably . . . refer to inanimate objects," i.e. those inanimate masses which were separated from each other in the beginning. These inanimate things move and undergo transformations by mere separation and combination, solidification and rarefaction, while "change by this means is, of course, unknown in the organic world with its system of Mind and Parts."

Peck's article is difficult to read and his interpretation intricate and not always clear or consistent, something which Peck himself acknowledged in his next article (see Peck (80)) which he was spurred on to write because of widespread misunderstanding of this first article, among other things.

P. LEON (66), *The Homoeomeries of Anaxagoras* (1927): Leon relies heavily on Simplicius' interpretation of Anaxagoras' theory as well as on his own fantasy.

Before Mind entered the picture, all matter formed an indeterminate mass; but when Mind finally entered and arranged matter, it did so thoroughly, "going right through in every conceivable part *ad infinitum*." The result of this is that in every piece of matter, no matter how large, there is a *whole world*, complete with sun, moon, stars, men, agriculture, cities, and everything else. This is the essence of the theory of homoeomeries, "that the part is like the whole, or that the whole is present in the part, and that everything is in everything." Every part of the cosmos is like the cosmos as a whole. Indeed, since nothing can be created out of nothingness, "everything must have all things (fully formed!) in it."

Anaxagoras thus "presents us with an infinite multiplication apprehensible by the mind only, and not by the senses, of every entity." Mind itself is pure and homogeneous, and is in fact incorporeal. It is the pattern of the observed world; "the phenomenal temporal series has noumenal timeless duplicate . . . and the relation between the two is, of course, not one of time." It thus turns out that the "Parmenidean One is represented in his [Anaxagoras'] system by the presence of the whole in every part and by *nous*, which, like the One of Parmenides, is absolutely homogeneous."

According to Leon, Anaxagoras' theory meant also that *all* events, no matter when they occurred, somehow exist in all other events; "the universe as a series of events is such that every event past, present, or future contains every other past, present, or future, an idea analogous to that worked out by Professor Alexander in his *Space, Time, and Deity*."

G. SARTON (91), *Anaxagoras* (p. 86) (1927); (92), *Anaxagoras* (p. 241) (1959): Sarton's is a standard account. He considers Anaxagoras to have been more of a scientist than were the other early presocratics.

Anaxagoras pictured matter as being made up of seeds each of which is as complex as the whole. Thus there is no difference between the whole universe and any of its parts, inasmuch as all are the same in composition (sic!). "To use a modern image (which I admit is a dangerous procedure) the seeds are like points of initial (fortuitous?) 'organization' which serve eventually as ferments for the general organization. Lucretius [sic!] called those seeds homoeomeria" (Note 12, (92)).

Anaxagoras' theory contained two important features: Mind, which is contrasted with matter; and the concept of an initial and everlasting vortex whose purpose it is to arrange matter. As for Mind, it is not very well defined, "and may be interpreted as a physical force as well as a spiritual one" (p. 242, (92)). "To go to another extreme, *nus* might be translated by energy, but it is better to keep the Greek term and to admit an ignorance of its exact meaning" (Note 11, (92)).

C. BAILEY (3), *The Pluralists: Anaxagoras* (p. 34) and esp. Appendix I: *On the Theory of Anaxagoras* (p. 537), (1928): In this work Bailey outlined a theory from which he later essentially retreated (see next entry). He begins by attacking the standard interpretation, the interpretation of Tannery-Burnet, the interpretation of Giussani, and that of Peck; and then he proceeds to outline his own interpretation. It is worth noting that he considers Simplicius' commentary *In Phys.* 203a as "in fact the clearest and most convincing explanation of exactly what I believe to have been Anaxagoras' theory" (p. 554).

The essential point of Bailey's explanation is that in fact the original chaotic mixture was not a collection of juxtaposed material particles, but a *chemical fusion* of all things in which you *know* the constituents to be present but can never perceive them: "things . . . are, as it were, completely merged in a new substance" in "a union . . . more like our notion of chemical fusion." (Bailey's notion of chemical fusion is extremely interesting, but it bears little resemblance to the notion held by chemists.) In addition to this infinitely extended fusion there exists a corporeal substance which is a "mind-stuff"; it too is infinite. Moreover since it is material and thus can only extert control over other things by direct physical contact (see NIETZSCHE above), it must be spread through the mixture without being fused to the mixture. By itself, the mixture is static, but wherever there is Mind (sic!—wasn't it supposedly everywhere?) a rotational motion arises which causes little bits of the mixture to break off (sic!—where do they go?). These pieces, which "happen to be broken off by the rotation," are indefinitely subdivisible and are made of the same stuff as the mixture. But because they happen to be broken off in little chunks they are capable of becoming the seeds of all things, since they are different from one another, having arisen from different parts of the original mixture—and the fused mixture itself was not homogeneous, but rather had different properties prevailing in different places. Thus, depending on where in the mixture the pieces break off, different seeds appear, all of which contain all things, because they are pieces of the original fusion.

After the seeds are broken off they separate from each other, and seeds of the same kind are conjoined to one another to form compound bodies—this time by simple juxtaposition—in which one kind of seed predominates, though other kinds are also mixed with them. In this way things were originally formed, and change occurs today too in the same way. For example, through chewing and digestion the seeds of flesh which are found in bread in some minority number are extracted from bread, just as Mind's rotation separated off different seeds initially. It is not clear from Bailey's account exactly what Mind is doing now.

C. BAILEY (4), *Vol.* 2 (p. 743) (1950; original ed. 1947): After discussing the 'problem of Anaxagoras' in the light of previous research Bailey now concludes the following: "Much ingenuity has been spent by modern critics in the endeavour to reconcile the two apparently contradictory theories [viz. that all is in all and that each body is made up of parts like the whole], but as yet no solution seems to have been reached which is both tenable in itself and will tally with the extant fragments. It is possible that Anaxagoras himself had not thought out the problem in its full implications."

L. ROBIN (89), *Ch. 7: The Mechanism of Quality and Mind. Anaxagoras of Clazomenae* (p. 122) (1928^2): For Robin, Eleatic thought was the major influence on Anaxagoras.

The basis of Anaxagoras' theory of matter, as Robin sees it, is the concept of pure quality bound to pure extension (rather than to matter): "So sensible becoming, which is unintelligible in respect of quality, becomes intelligible as soon as it is transferred to extension and, the being of quality remaining unchangeable, brought down to movement in place." The seeds then are not merely common, superficial qualities (as Tannery would have it), but "the most determinate and richest qualifications, those which have the names of things and in which the common qualities are contained." They involve an infinitude of qualitative differences, "and the actually infinite division of quality is accompanied by a no less actually infinite division of space; . . . every qualitative difference therefore, is a 'portion' (*moira*), and these portions . . . are divided *ad infinitum* into identical portions," though this infinite subdivision cannot in fact be effected. Any particular perceived object thus gets its characteristic properties from the assemblages of qualitatively identical components that dominate *in volume.* It should be remarked that Robin does not always convey his meaning with absolute clarity.

As for Mind, its action takes place causally, without any end or goal in view. Mind acts by virtue of its being the thinnest of all substances, a property which enables it to slip through the rest of matter.

Anaxagoras, then, made two major contributions to the progress of thought: (1) He endowed quality with the property of really existing, striving to raise it from the realm of sensation to intelligibility. In this he clearly foreshadowed the theory which constructed reality with forms or ideals. (2) He introduced an efficient cause, Mind, which, though it did not in fact act teleologically, paved the way for the substitution of an ideal causality of the *end* and of the *good,* in place of the prevailing material causality.

E. DERENNE (35), *Trials of Philosophers at Athens on the Grounds of Impiety During the Fifth and Fourth Century* B.C.E.; *Ch. 1: The Trial of Anaxagoras* (p. 13) (1930): This monograph brings together all the stories which can be found in ancient literature about trials held in Athens on charges of impiety in the indicated time span. Some 271 pages are spent recounting all the traditions concerning trials of Anaxagoras, Protagoras, Diagoras, Socrates, Demades, Aristotle, Theophrastus, Stilpo, and Theodorus; and the traditions are supplemented by discussions and reconstructions at the hand of the author. We have here an excellent instance of how a mass of fabricated and unfounded legends can create a completely false impression, in this case that the fifth and fourth centuries were a time when freedom of thought was constantly infringed upon at Athens.

F. M. CORNFORD (28), *Anaxagoras' Theory of Matter* (1930): Cornford's account, which comes to the conclusion that Aristotle completely misunderstood Anaxagoras' theory and that under Aristotle's influence all of antiquity misunderstood it, proceeds after lengthy arguments to suggest an interpretation in the Tannery-Rivaud-Robin tradition (*q.v.*) with some modifications along lines drawn by Peck (*q.v.*). However, Cornford's interpretation contains some innovations arising from the particular sequence of reasoning he uses in his attempt to reconstruct the theory on the basis of common sense and, as support for this, on the basis of the fragments. Cornford's argument runs as follows:

Anaxagoras' theory rests on two propositions: (1) the Principle of Homoeomereity, which says that natural substances consist of parts all exactly like each other and like the whole; e.g. gold consists of parts "every one of them gold and nothing else" (cf. source 97; Cornford accepts Lucretius' first interpretation of Anaxagoras' theory). (2) The principle that there is a portion of everything in everything; e.g. gold contains in it portions of every other substance in the world. Cornford devotes his efforts to resolving the obvious contradiction between these two statements. He does this by accepting the first as true and seeking a new explanation for the second: "What does 'everything' mean? . . . If taken to mean that there is a portion of every material substance in every material substance, the proposition leads to a result for which 'uneconomical' is an indulgent epithet." (Sic! Compare Heinius above, who uses substantially the same argument.)

Now Anaxagoras started from Parmenides' Principle of No Becoming, which stated that something cannot come out of nothing. This led him to assume a plurality of unalterable "things that are," together with motion in space. He then focused his attention on living things, especially on their growth from undifferentiated germ and from food whose appearance is different from their own. By the Principle of No Becoming Anaxagoras concluded that both seeds and foods contain in them *just those tissues which grow from them*, and nothing else. Thus seeds are composite molecules containing all tissues of the adult organism held together by some force ascribable to Mind; for example, food grains such as corn contain in addition to the tissues of adult corn those particular animal tissues nourished from them, and no more. So far however there was no occasion for Anaxagoras to assume that *all* things are in *all* things!

Anaxagoras next turned to cosmology, where he based his theory on the analogy to individual organisms. Thus he viewed the mixture as "the germ of the world, analogous to the germ of the living creature and, for the same reason, as complex as the final product [the world] that emerges from it." The mixture contains all seeds, and nothing else; the 'opposites' referred to in connection with the mixture are *not* distinct entities in the mixture, but "can here be understood as collective names for all the things which, when evolution has gone far enough, will be so distinguished and named." "There is nothing in this fragment [fragment 4 of Diels-Kranz (37)] that cannot be interpreted consistently with the view that the original Mixture consisted of the Seeds only." "All that happens" in the formation of the world "is that these particles come together or move apart in space." Again Cornford notes that nothing in the theory up to this point of its reconstructed development requires the assumption of "a portion of *everything* in *everything*." This assumption then can only apply to the remainder of the theory, which is concerned with the Seeds and Opposites.

The "things" which *must* contain portions of everything are the

Seeds. Only if the seeds contained portions of everything would every object contain portions of everything, since it is clear that every object does *not* contain all Seeds—indeed, it is even possible to isolate *pure Seeds*—so that everything would not contain a portion of everything if the seeds did not. And the "things" which every seed contains, of which each seed is composed in different proportions, are none other than "quality-things," i.e. the Opposites, understood now in the *singular* sense as the basic quality-things (as opposed to the *collective* sense used in the cosmogony, as described above, where Opposites refer to collections of substances having the properties referred to; e.g. "the Hot" refers to *hot things* in the collective sense, to the *hot quality-stuff* in the singular sense). It is important to understand however that the Opposites are not *prior* things; they are not atomic components of the homoeomeries; they cannot be isolated by cutting up the seeds. They exist *only in the Seeds!* "The quality-things . . . must exist only *in* the Seeds; and being things, they are not mere attributes inhering in subjects other than themselves, but the Seeds will actually be composed of 'portions' of them."

Thus Cornford concludes that 'a portion of everything in everything' means that there is a portion of every Opposite in all Seeds (hence in all things); so that the first 'everything' in the phrase refers to Opposites, and the second 'everything' refers to Seeds or things in general. Cornford suggests that the second 'everything' may also refer to Opposites, but the situation is not clear, due to Anaxagoras' vagueness on the subject.

The two contradictory statements Cornford set out in the beginning as the central paradox of Anaxagoras' theory have thus been resolved. He makes it clear that it was only due to Anaxagoras' unclear language and to Aristotle's complete misunderstanding (which misled Theophrastus and through him all the text-book writers) that the correct interpretation had to wait till the twentieth century to see the light.

A. L. PECK (80), *Anaxagoras: Predication as a Problem in Physics* (1931): These two articles were written with the express purpose of clarifying and modifying Peck's earlier interpretation (*q.v.*); they also contain an attempt to refute in detail much of Cornford's work (see the preceding entry).

Peck discusses at length the meaning of 'homoeomery', leaning most heavily on Aristotle's testimony and usage, and concludes that in Anaxagoras' system the homoeomeries were *organic:* "This will give us a consistent scheme, in which organic (animal and vegetable) substances will be elemental, while inorganic substances . . . will not be elemental, but will consist of tiny bits of all the elements mixed together" (p. 30). In addition however Anaxagoras *also* classed the qualities among the elements; "These, of course, were at that time the names of actual substances, or kinds of matter, not of 'qualities'."

Matter is made up of units of matter which are infinitely subdivisible and which are compounded out of *all* the elements, homoeomeries *and* Opposites; the units of matter differ only in respect of composition, i.e. in the proportion in which the elements appear in the compound making up the unit. In organic matter, the units are such that organic elements prevail; in inorganic substance not organic elements, but some of the Opposites prevail. (See p. 116, Note 6, where this is called "an interesting stage in the history of predication.") In addition, the theory speaks of Seeds, which should be understood in the ordinary sense to refer to seeds of plants and animals.

The cosmogony has two major stages: the first was brought about by the revolution caused by Mind and in it the mixture was separated on a large scale into Opposites, and hence into the gross configurations of different kinds of inorganic matter such as earth, water, air, etc.; the second stage led to the formation of living things (compare SCHLEIERMACHER and RITTER). In the second stage Mind gives the seeds of living animals and vegetables the power to grow and to develop those substances in them which will be more apparent than others in the mature organism, just as it controls the process of digestion and growth by directly transferring *biologically*, not mechanically (p. 119, Note 16), the flesh which is in food to the flesh in the body. After the tissues useful for bodily growth are extracted from the food, inorganic matter is left, matter which contains mostly Opposites and some vegetable matter which "(because it lacks the special control of *nous*) no longer has the power of growth."

A. L. PECK (81), *Anaxagoras* (Vol. I, p. 884) (1960): This is a brief summary of Peck's interpretation. It begins with the following statement: "A careful examination of the existing fragments and of Aristotle's evidence enables us to arrive at an interpretation which yields a self-consistent and chronologically appropriate system and one by which Anaxagoras might reasonably have conceived himself to be solving the problems which in fact confronted him; no interpretation that fails in these respects can be satisfactory."

As an illustration of how all things contain all of the other "ultimate stuffs"—homoeomeries and qualities—Peck cites the following: "in a pint of milk there is a portion of everything; but it appears to us to be fluid and white and milk because there is in it a larger portion of the fluid, of the white and of milk than of any other things."

Peck notes that it is incorrect to charge Anaxagoras with using Mind as a *deus ex machina,* since Anaxagoras clearly conceived Mind to be involved directly in the control of all processes always. The real objection of Socrates and of Aristotle according to Peck is that "Anaxagoras did not show that *nous* acted and acts *for the best;* but Anaxagoras may have assumed that this was obvious."

H. DILLER (38), *Anaxagoras' Fragment 20* (1931): This brief note attacks the assignment of the contents of the so-called fragment, discussed by Schultz (*q.v.*) and listed by Diels-Kranz (37) as fragment 20, to Anaxagoras. Diller notes that the subject matter is far more appropriate to Hesiod, and that the corrupt Hebrew names read by Schultz as "Anaxagoras" are probably more easily read as "Hesiod." The argument concentrates however on the contents of the passage, concerning which Diller says: "I really cannot believe that Anaxagoras has the least to do with all this" ("Ich glaube wirklich nicht, dass Anaxagoras mit dem allem das geringste zu tun hat.").

K. DEICHGRAEBER (33), *The Hymnic Element in Presocratic Philosophical Prose* (1933): The basic point of this article is that Anaxagoras' writings—especially on Mind—are in the tradition of monotheistic hymns in Greece. The argument rests on a minute study of style and choice of words, especially on the "very typical" practice of stringing together predicates with *kai*, 'and' (the "*kai* form").

On the meaning of *apeiron* (infinite, unbounded) as applied to Mind, the author concludes that it means that Mind has no relation to things, can not be affected, exists independently of them, etc.

S. LURIA (68), *The Theory of Infinitesimals Held by the Ancient Atomists* (p. 106 and esp. pp. 110–114) (1933): Luria argues that on the generally held ancient view an infinite number of measures of any size whatever, other than an *absolutely vanishing* size (viz. a point), always yield an infinitely large measure when they are combined. He is emphatic in maintaining on the basis of this general statement that Anaxagoras did not in fact have a theory of infinitesimals. Luria rejects as well any comparison between Anaxagoras' theory and the later theory of limits (exhaustion) as developed for example by Euclid: "The similarity is about of the same kind as that between primitive totemism and Darwinism (both systems hold that man arose from the animals). It is not *what* the theory contains, but *how* the theory deals with things that is of primary importance in such matters" ("Doch die Aehnlichkeit ist nur derselben Art, wie z.B. die zwischen dem Totemismus der Naturvoelker und der darwinistichen lehre (beide Theorien behaupten die Entstehung des Menschen aus einem Tier). Nicht *was*, sondern *wie* spielt in solchen Dingen die Hauptrolle.").

Luria adds an interesting remark on the attempt made by his predecessors to single out among known historical figures the people with whom Zeno was arguing, a remark which could aptly be applied to all such attempts at identification, especially in the case of the presocratics: "Any actual guess as to identity of Zeno's opponents is perhaps premature in light of the current state of knowledge" ("Jede konkrete Vermutung ueber die Persoenlichkeit des Gegners Zenon wird also beim jetzigen Stand der Wissenschaft vielleicht verfrueht sein.").

H. CHERNISS (23), *Aristotle's Criticism of Presocratic Philosophy* (passim) (1935): This is a long rambling book in which for the most part Aristotle's physical and metaphysical treatises are reviewed book by book, chapter by chapter, and the sections dealing with presocratic philosophers paraphrased and commented upon as they come up. The result is a work which in its planned structure is as disconnected as are the occasional references to his predecessors made by Aristotle in the course of his lectures. Nowhere does the author give a coherent organized account of Aristotle's treatment of any one of the presocratics; nor is there any coherent presentation anywhere (since it is taken to be beyond the scope of the book; see p. 347) of Cherniss' views of the theories of the presocratics, so that the reader never gets a developed picture of the interpretations he holds to be true, against which he measures Aristotle's veracity.

The central thesis of the book is that Aristotle cannot be used as a source for studying presocratic philosophy, since he consistently distorts and misunderstands the theories of his predecessors in order to polemicize against them, and in order to use them as a foil against which he can build up his own system through argument and refutation. This thesis is maintained with absolute conviction; although it is clear that only when the theories which can be assigned with some confidence to each of the presocratics are understood, and only when all the mentions made by Aristotle of each individual philosopher are juxtaposed, grasped in all their implications, and carefully compared, can any significant judgment be passed on the degree of reliability and freedom from contradiction in Aristotle's criticisms.

There is a major fault in Cherniss' work which from the outset vitiates much of his thesis: he has failed to distinguish between lack of reliability as a reporter, and lack of good judgment as a critic. Over and over Cherniss presents a large number of demonstrations—erroneous for the most part, in our opinion, but we may grant them for the argument here—that Aristotle's *criticisms* or *objections* to particular views of his predecessors are poor, or wrong, or inadequate, or based on a lack of sympathy with, or understanding of, the true intent of his predecessor's views. He then concludes that this short-coming shows Aristotle's unreliability *as a reporter* even when his aim was only to give a factual account of the contents of his predecessor's theories; and hence that it proves Aristotle's uselessness as a source of information concerning presocratic philosophy. It is however not inherently impossible that someone might present the contents of a theory—the "facts" of the case—correctly, and then criticize them poorly or incorrectly, or even display ignorance of their true intent. Cherniss' failure to perceive this clearly and to mark off carefully the distinction between these two concepts renders most of his book worthless.

One example of Cherniss' claim that Aristotle is unreliable—and one which happens also to be among the minority of instances where he means by this that Aristotle *reports facts* in a purposely distorted way—will serve to illustrate Cherniss' method. The subject is Anaxagoras' theory of earthquakes (p. 208). On the basis of some later text book account Cherniss has concluded that Anaxagoras' theory *must* have involved the action of *air* which gets under the earth, and hence that Aristotle must have purposely distorted Anaxagoras' theory when he presented the theory as stating that *fire* gets under the earth. According to Cherniss, Aristotle did so in order to present Anaxagoras in an absurd light for saying that fire—which naturally rises—sometimes capriciously falls. This enabled Aristotle to go on and, in refuting this version of Anaxagoras' theory, to make his own point that fire always rises when left alone. Cherniss is willing to concede that Aristotle's distortion might have been based on the presence of fire in addition to air *somewhere* in the theory—but this was surely not fire that *fell* under the earth. Perhaps, suggests the author, Anaxagoras' theory also spoke of fire which was separated out of the air under the earth, squeezed out of the air (for example) when the air was compressed!

F. ENRIQUES and G. DE SANTILLANA (41), *The Last Greek "Physiologers"* (1936): The authors view the pluralism of Anaxagoras as an answer to the Eleatics. They credit Anaxagoras with using non-mechanistic explanations to a lesser extent than his predecessors, despite his introduction of Mind, since he used Mind only to start things off.

For Anaxagoras, matter was a mixture of an infinite number of infinitesimally small quality-particles. The reason bodies fall is that the centrifugal force of the whirl (which encompasses us even now) has more trouble displacing large, compact bodies than light bodies, so that light bodies rush outwards more, leaving behind a void in the direction of the earth which is filled by heavy bodies falling inward. The earth is also kept in place by the vortex, just as a spinning top keeps its direction in space (sic). Anaxagoras clearly believed in many worlds, but he also clearly believed that each world was constantly spreading out and becoming larger, so that eventually their outer layers of fire would have to collide in a great conflagration. Enriques and Santillana note (p. 20, Note 1) that there is unfortunately no hint of such a catastrophe in the sources, so that they cannot even attempt to resolve the above inconsistency in Anaxagoras' theory.

O. GIGON (49), *Notes on Anaxagoras* (1936): This article is a discussion of the fragments one by one (and it includes some philological notes very sensitive to the exact wording of Anaxagoras' statements) in the attempt to discover all the influences exerted on Anaxagoras by his predecessors and contemporaries. The picture of Anaxagoras which emerges is that of a philosophical garbage pail into which were thrown the doctrines of all his predecessors in a jumbled manner; he appears to be a man who over and over again juxtaposed blatantly contradictory statements without so much as attempting to resolve the contradictions. (After reading Gigon one feels very lucky to have just those fragments of the other presocratics which happen to contain the precise passages that influenced Anaxagoras' thought.)

Some examples of the contradictory elements Gigon sees juxtaposed in Anaxagoras' theory are the following: (1) Anaxagoras reacts to Zeno's arguments, which used the contrast between the large and the small to construct a *reductio ad absurdum*, by taking the same paradoxical pair, 'large' and 'small', as the very starting point of his theory. (2) Air and aether coexist as contradictories, the one thin and the other dense, etc. (3) On the one hand air and aether, the heavenly elements (the name 'aether' being chosen to accentuate the fact that it is a *heavenly* fire, and is not the same as terrestrial fire), make up the sky—as in Anaximander's theory; on the other hand the heavenly *bodies* are not made out of air and aether. (4) The units or particles out of which things are made are themselves complex and manifold: "Just as visible things are manifold in number and in kind . . . so too are the units which make them up. Plurality and unity complement one another" ("Wie die sichtbaren Dinge vielfach an Zahl und Art sind . . . Genau so auch die Einheiten, die sie konstituieren. Vielheit und Einheit entsprechen einander."). (5) Four elementary opposite-pairs are considered to be elements, side by side with the seeds or homoeomeries. One must not even attempt to work out this paradox in a logical manner, since Anaxagoras himself did not bother to reconcile the opposites and the seeds. (6) The statement is made in the theory that all things have the same number of parts, but it is also stated that the nature of each thing is determined by its most numerous component. (7) Infinitely fast motion during the cosmogony is present in the theory, as is motion starting from a point and spreading out.

Gigon just touches lightly on Anaxagoras' Mind, stating that the idea of Mind is an intricate composite of the ideas of many of Anaxagoras' predecessors, introduced into the system by Anaxagoras because he had heard them—just as he threw everything else he heard into the system. For there was no real need to introduce Mind as a source of motion, since the Milesians had long since come up with the idea that matter can move by itself.

Gigon himself sees no contradiction in assuming at the same time that Anaxagoras was busy picking arguments with his colleagues and predecessors on various points of logic, and that he was capable of harboring large numbers of the most blatant contradictions in his own theory. Gigon therefore sees no need to attempt to understand Anaxagoras' theory as a coherent whole. He views Anaxagoras as a typical example of a primitive thinker who is free of all mythological influences but has not yet developed a method for observing and studying nature.

O. JOEHRENS (61), *The Fragments of Anaxagoras* (1939): Joehrens tells us at the outset that he wishes to find out what Anaxagoras' theory was from Anaxagoras' own words—i.e. from the fragments taken together with Simplicius' brilliant explanations—rather than from secondary sources such as Aristotle, who was not interested in understanding his predecessors and whose words can be brought to support *any* reconstruction of Anaxagoras' theory. Joehrens also dissociates himself from studies like those of Gigon (*q.v.*) which seek to investigate Anaxagoras by relating him to other thinkers of the time; nor does the author have any recourse at all to modern secondary sources, except in a very few cases. Nevertheless, one looks in vain here for a thorough-going study of the *text* of the fragments. Joehrens accepts the text of Diels almost without reservation; and for the most part he accepts and uses the translations of Kranz. His book is thus a kind of stylistic literary study of the meaning conveyed by the fragments.

Joehrens' interpretation of Anaxagoras' theory of matter can be summarized in the statement that for Anaxagoras all things were basic, where by "things" are meant qualities: substances: neither: both. As Joehrens sees it, Anaxagoras would simply not have differentiated between qualities and substances: 'earth' and 'the dense' are synonyms, and so forth. It is true that Anaxagoras' thinking is basically quality-oriented, and that he had a good idea of the dense continuum formed by qualities; but basically both Burnet *and* the standard interpretations are right. Furthermore Anaxagoras did not distinguish substance in mass from pieces of any size—substances exist in pieces of all sizes—nor did he differentiate among substances as regards their elementarity; for Anaxagoras there simply was no difference between air, earth, fire, water, and any other substance.

Mind is "one thing among other things" ("ein Ding unter anderen Dingen"; p. 68), but separate from other things and entirely different in nature. It is essentially incorporeal.

Anaxagoras' method was to proceed from a consideration of the universe as a whole to the consideration of detailed objects and phenomena. Joehrens assures us (p. 13) that this was Anaxagoras' *real* method, despite the fact that Simplicius (sic!) tells us that Anaxagoras proceeded from a consideration of individual objects to a consideration of the universe as a whole.

The author believes that it is a mistake to hold, as some do, that Anaxagoras' theory was an anthropocentric theory dealing with the origin of civilization ("anthropozentrischen Kulturentstehungslehre").

A. REY (85), *Book II: The Beginnings of the Maturity of Greek Scientific Thought; Ch. 1: Anaxagoras' Solution* (1939): Rey finds that Anaxagoras was subject to all sorts of influences, especially to the influence of Pythagorean thought (in addition to the obvious Eleatic and Ionian influences). Thus for example Anaxagoras' chaos has particles containing all qualities, so that it is a typically Ionian qualitative mixture of the primordial type; except that the Eleatic influence on Anaxagoras makes the qualities eternal and unchanging.

Anaxagoras had in his theory two basic elements which he used to explain phenomena: Mind, which was a combination of spiritualism and mechanism; and the principle of the affinity of like for like, which is a combination of magical and scientific thought.

Anaxagoras did not influence the development of physics, but he had an influence on the development of science. In particular three seeds planted by him bore fruit and developed later: A. The principle that like is attracted to like. B. The concept of infinity. (Anaxagoras had an intuitive grasp of the infinitely large and infinitely divisible, which was basically the first true concept of the continuum. Indeed in the second half of the fifth century B.C.E. infinity took on a reality which it never took on again.) (Sic!) C. The idea that something cannot come out of nothing, an idea to which Anaxagoras gave new impetus.

W. BROECKER (14), *The Theory of Anaxagoras* (1942/43): Broecker finds Anaxagoras to be a follower of Parmenides, and no one else. According to Broecker there have been two main interpretations of Anaxagoras: one says that the theory of matter is superb physics, the theory of Mind very unimportant (e.g. Tannery); the other says that the theory of matter is poor physics, the theory of Mind a great theory (e.g. Zeller). According to Broecker both views essentially reduce to his interpretation, which follows:

Matter is composed of seeds, each of which fills all of space. The seeds coexist and interpenetrate, and are capable of varying their density from point to point, so that the net effect observed varies according to the seed which predominates at any point. "Each seed is an elementary substance which fills the entire world; all the seeds interpenetrate, so that everywhere and at all times all the seeds are together" ("Jeder Same ist ein Elementarstoff, der die ganze Welt erfuellt, alle Samen durchdringen sich gegenseitig, so dass ueberall und jederzeit alle Samen beisammen sind"; p. 180). "The Existent is everywhere a mixture of all the seeds, in which all the interpenetrating seeds are together and every seed is everywhere" ("Das Seiende ist ueberall Allsamenheit, in der all Samen sich durchdringend beisammen sind, jeder Same ist ueberall."). Thus "a seed is not something small, but . . . something hidden from view" ("Der Same ist nicht das kleine, sondern . . . das Verborgene.").

Mind on the other hand cannot be a force separate from everything else, because this would involve a dualism in a theory which is entirely based on the reconciliation of manifold appearances with One Being. Rather, the essence of Mind is to bring to view what is hidden, an act which contains within it the meaning of Mind's "knowledge." Thus matter is not a passive mass waiting to be acted on from outside; but it is "laden with forms which are hidden in it" ("geladen mit Gestalten, die in ihr verborgen sind"; p. 186); so that Mind does not bring in something from the outside, but "does nothing other than set free the hidden riches of Mother Nature and bring them into the light of true reality" (". . . leistet nichts anderes, als den verborgenen Reichtum dieser Mutter Natur zu befreien und ans Licht der Wahrheit zu bringen."). "Without Mind, the mixture has no reality, and without the mixture, Mind has no being" ("Ohne den *nous* hat das *homou panta* keine Wahrheit, und ohne das *homou panta* hat der *nous* kein Sein."). "Reason is not basically separate and independent, such that it then discharges itself upon Nature—as Hegel, following Plato, taught—but it is basically the revealer of hidden Nature and only as a result of this can it be thought of as existing independent and separate. In this we can learn something from Anaxagoras" ("Die Vernunft ist nicht zunaechst bei sich selbst, um sich sodann zu Natur zu entlassen, wie Hegel im Gefolge Platos lehrt, sondern sie ist urspruenglich als ein Eroeffnen der Verschlossenen Natur und erst abgeleiteterweise also ein bei sich selbst Verweilendes zu denken. Hier koennen wir von Anaxagoras lernen"; p. 189).

A. NOLTE (78), *Aristotle and Anaxagoras' Theory of Mind* (1942/43): This is a violent attack on Aristotle's account of Anaxagoras' theory of Mind. Nolte uses the so-called fragments, as he interprets them, as his starting point, and assumes that we have in them the entire content of the theory of Mind.

Nolte thinks that Mind is material and acts mechanically. (He holds that the verb *kinein* was used by Anaxagoras to mean 'to turn'.) Since it was never meant to be a teleological factor in the theory, Plato and Aristotle had no grounds to complain. Mind itself was completely mixed in with matter in the original chaos; in the process of separation that led to the formation of the cosmos Mind began to purge itself of all other things alien to it, and this process is still going on today.

D. CIURNELLI (24), *The Philosophy of Anaxagoras* (1947): The author promises us a completely objective analysis of the origins and structure of Anaxagoras' system, which will avoid the one-sided views of ancients and moderns. The result is a fairly standard account, with a somewhat unique order of presentation: The chapters are arranged in the order Life (of Anaxagoras); Mind; Soul ("Immanent Mind"); Nature; Perception.

Ciurnelli thinks that Mind is almost incorporeal in Anaxagoras' theory. It stands in contrast to ordinary matter in that matter is passive while Mind is absolutely active. A problem which apparently did not worry Anaxagoras is how two infinites, Mind and Matter, can be compatible. In the theory, Mind played a role of both an effective cause and teleological principle, a role which did not appear to Anaxagoras to harbor any contradictions.

Matter is composed of things ("cose") and quality-stuffs. Though Anaxagoras spoke of infinitesimals, they were not used as Leibniz' monads were used, and they did not even serve to explain the continuous variation of quality; indeed Anaxagoras had little more than a primitive intuitive grasp of the concept of a quality varying in intensity.

Anaxagoras' theory is purely mechanistic, not dynamic at all. But in fact in the theory the eternally immutable things come to participate in processes of becoming and change, so that in the last analysis the mechanism virtually amounts to dynamism. In the same way Anaxagoras' extreme realism and dogmatism turns into relativism when he comes to deal with perception. In general Ciurnelli finds that Anaxagoras fused the theories of his predecessors into his theory with considerable imperfection, and that he juxtaposed two entirely opposed world views (Eleatic and Ionian) without really reconciling them (cf. GIGON).

W. JAEGER (60), *Ch. 9: The Teleological Thinkers: Anaxagoras and Diogenes* (1947): Jaeger finds that "it is not easy to form an idea of Anaxagoras' views on nature in general" (p. 155), and disregards the theory of homoeomeries. He notes that Anaxagoras is often mentioned for his remarkable meteorological observations, and that "Anaxagoras is interested in investigating certain comparatively rare phenomena" (such as "his celebrated observation" of the stone that fell at Aegospotami). Actually, however, Anaxagoras started from dietetics (sic!) and the theory of nutrition.

Jaeger accepts the conclusions of Deichgraeber (*q.v.*) on the hymnic nature of the long fragment on Mind, and concludes that Mind is divine, and that the mind in us is part of the divine in us. Mind planned out the pattern of the universe ahead of time according to a "preconceived world-plan," and "has ordered everything from the first according to a definite plan" (p. 163). (Thus Jaeger accepts much of Simplicius' interpretations, Neoplatonism and all; see for example Note 9, p. 239.) Anaxagoras presents a picture of "a mechanical process as automatic as possible, whether pre-established as a whole in all its phases within the divine Mind or merely anticipated by it." Thus he considered Mind "the very essence of the Divine" (p. 164); "to Anaxagoras the Divine is pure reason—the activity of the Mind as taskmaster. Man has direct access to the Divine by the similar powers that he bears within himself."

Jaeger writes that "Anaxagoras himself had not distinguished Mind sharply from 'the other things': despite its freedom from any admixture, it remained for him 'the thing . . . that is purest and thinnest'. He was therefore not yet aware of a real opposition between matter and Mind" (p. 166). A little later he says that Mind is "distinguished sharply (sic) from the rest of the corporeal world as the 'purest and thinnest body' " (p. 171).

G. GALLI (48), *Anaxagoras* (1948): This article is mainly concerned with the metaphysical aspects of Anaxagoras' philosophy. Thus we learn for example that for Anaxagoras the mixture is pure negation; that Mind works through the principle of identity which makes things come to be by the attraction of like for like; that the essence of reality is intellectual for Anaxagoras, much as it was for Parmenides; and that a major failing of the theory is that it takes no *real* account of coming to be—i.e. that it is only a tentative reconciliation between becoming and permanence—since it admits no real qualitative change, only quantitative change.

As for some of the details of the theory, matter is composed of pure basic "particles infinitely small and infinitely subdivisible" (?) ("particelle infinitamente piccole, divisibili all' infinito"). Mind is material and finite; and in fact the theory of Mind is rather primitive and undeveloped.

J. ZAFIROPULO (109), *Anaxagoras of Clazomenae* (1948): One purpose of this book is to show that presocratic philosophers were by no means scientists, but metaphysicians under considerable influence from myth. This point is discussed at length in the Introduction, which extends for 259 pages and makes up the major part of the book. Here we learn, among other things, all about the Pythagorean myth which according to the author permeated early Greek thought—a myth which contained elements like a divine world-soul, a spiritual realm of all souls taken together which interacts with the material realm, etc.

The author's interpretation of Anaxagoras resembles that of Nietzsche and Tannery (*q.v.*). We find here quality-fluids which come in discrete pieces (quality-elements) which are in turn ultimately composed of quality points (sic). (Zafiropulo completely confuses points with infinitesimals.) And we find also the spirit-fluid, Mind. In the tradition initiated by Tannery and developed by Mieli (*q.v.*) Zafiropulo has a separate chapter in which he presents his interpretation of Anaxagoras' theory in the language of modern science, replete with analogies to and anticipations of differential equations, different infinite cardinal numbers, quanta, wave-particle dualities, etc.

F. CLEVE (26), *The Philosophy of Anaxagoras* (1949): The peculiar format of this book, the frenzied prose in the expository passages as well as in the attacks on other interpretations, and the wild fantasy pervading every chapter make it very difficult to take this work seriously and to evaluate it by normal criteria.

Cleve attacks Aristotle for confusing Anaxagoras with Anaximander, and for carelessly confusing such statements as "the elements are homoeomerous" and "the homoeomeries are elements," thus hopelessly distorting Anaxagoras' theory.

Cleve reconstructs an elaborate technical terminology used by Anaxagoras, some of it unfortunately lost and all of it previously misunderstood. The theory of matter is based on pure qualities, such as 'great' and 'small' (sic!), which have extension and are able to interpenetrate (compare RIVAUD, ROBIN, BROECKER). Particles of these basic qualities in various proportions are compounded by an "into-one-another," a "true mutual penetration," to form molecules. A homogeneous body is then built up of one and only one kind of molecular species, containing however *all* the basic elements. It is important to realize that Anaxagoras does not draw the distinction that later comes into play between matter and non-matter.

Mind is a pure and absolutely homogeneous consciousness-stuff.

"Nous is the non-molecularized medium in which the molecules are embedded"; but the molecules are impenetrable to Mind, so that Mind is able to move them. Mind has always known all things; it "knows all the mechanical possibilities . . . lying in the elements and, out of those various possible courses of a world, chooses the most beautiful and the most variegated (not, 'the best,' which is much too hazy)." Individual minds are distinguished from the universal Mind as follows: Some molecules are like balloons having Mind locked into them (since Mind, as we saw, cannot penetrate quality-matter), and these form the individual self of the animal organism. The Mind thus locked up in a person is in touch only with the walls of the prison, and gets to know only through experiences transmitted by the senses, though it is too small to know very much. Sleep and death unite these individual pieces of Mind with the cosmic one; in addition death is also characterized by the cessation of bodily life functions which are normally carried on through the agency of the world-Mind.

The cosmogony was the result of Mind spreading out globularly from a point. The earth is flattened due to the action of centrifugal force. Cleve is convinced that there is spherical symmetry in the theory, but no up-down asymmetry. Therefore it cannot be true that Anaxagoras said the earth rests on a cushion of air. Instead, the statement that the earth is supported by air means that air pressure all around resists the oscillations of the earth about a diameter; and both the earth and the air around it rotate about an axis perpendicular to the plane of the earth. What makes bodies fall straight down (rather than toward the center) is the centrifugal force thus generated, which counter-balances the radial component of the gravitational force and leaves only an up-down component.

According to Cleve (whose physics is confused, especially here) the action of the vortex is such that the centrifugal repulsion of heavy objects becomes greater as the center is approached. This leads to the following description of Anaxagoras' picture of contemporary cosmology: clods of stone form all through space by separating out of the aetherial mixture. These then proceed to fall inward towards the center, passing from one rotating aether stratum to another. The velocity of rotation of these strata increases towards the center, so that the falling stones eventually reach a stratum which rotates fast enough to keep them up. The stones then increase in size by the addition of more stone separated out of the surroundings, and they then fall further; until finally they strike the earth. In this way the stars and heavenly bodies are formed; and all of them will eventually strike the earth. Now since there are an infinite number of worlds going through processes of formation at an infinite number of equidistant points, the mixture will eventually be exhausted; so that a state of stability will be reached in which stars will no longer get heavier and fall, since there will be no heavy matter left in the surroundings. Finally, a period of cosmic destruction will set in, when the process of creation will be gone through exactly in reverse. Cleve feels that such a period is necessary to the symmetry of the theory and therefore must have been part of the theory although there is no evidence for it. Such cycles of world creation and destruction recur endlessly.

7. The Second Half of the Twentieth Century

C. CALVETTI (16), *The Metaphysics of Anaxagoras* (1950): This article is written in the technical language of present day metaphysicians. We are told that there are two things, ontology and the study of nature, metaphysics and physics, which Aristotle first clearly separated and which should never be confused. The presocratics always got these mixed up. For example Anaxagoras was a poor physicist though he was a very good metaphysician, since he imposed metaphysical considerations on physics, where they do not belong.

For the presocratics, the unity in nature was not a separate reality, but something *in* nature, viz. its uniting bond. Anaxagoras placed the unity of nature in Mind, which like matter has an infinitesimal structure in so far as it thinks about infinitesimal matters. Anaxagoras did not however formulate explicitly the teleological functions of Mind, but he intended them to be understood.

H. FRAENKEL (44), *Review of* ZAFIROPULO, CLEVE, *and* CIURNELLI (1950); (45), *Review of* CIURNELLI (an expansion of part of (44)) (p. 284) (1955): Fraenkel agrees with Zafiropulo that one should not "take the presocratic philosophers for fledgling physicists in the modern sense of the term rather than for metaphysicians who were trying . . . to harmonize the spiritual and the material." (44)

As Fraenkel sees it, for Anaxagoras "nature in the raw is primarily indiscriminate, and Mind is primarily the faculty for discrimination (hence his predilection for compounds of *krinein* . . .)." "It is through severing and recombining that the world of inanimate things is brought about. For the production of viable organisms, the seed or semen is differentiated . . . into the several stuffs that make up a plant or body . . . and for their growth and maintenance, the nourishment is similarly broken up into its several components." (44)

The main thing to realize, however, is that Anaxagoras' system is not physiological, but anthropocentric (compare JOEHRENS, a student of Fraenkel's). The ultimate achievement of Mind—the apex of the theory—is human civilization: "Finally, Mind creates civilization and a social order . . . The last point . . . stamps the Anaxagorean system as anthropocentric rather than physiocentric: the final triumph of Mind is human civilization."

Fraenkel admits that there is virtually no evidence, either in the so-called fragments or in the tradition, to support this thesis. But he ascribes this to the loss of the evidence through neglect and lack of interest in this central point of the theory. "If our tradition yields scanty evidence for the general perspective of Anaxagoras' system, with human civilization at its apex, the reason is the one-sided interest of our main sources." (44)

B. MATES (69), *Review of* CLEVE (1950): Mates is skeptical of the possibility of reconstructing Anaxagoras' system. Concerning the fragments he says: "these fragments . . . are by no means clear in meaning . . . they appear to be inconsistent with one another and with the account given by Aristotle, whose testimony can hardly be ignored despite the notoriously biased way in which he dealt with his predecessors." On the attempts of modern scholarship to interpret the theory Mates can only say, "unfortunately, no two of the proposed interpretations agree." Commenting on what he considers to be Cleve's lack of acquaintance with the literature, Mates adds, "but in view of the nature of the subject it is difficult to regard this as a very serious fault."

G. VLASTOS (105), *The Physical Theory of Anaxagoras* (1950): Vlastos considers Tannery's work to be the "most important step ever taken toward the true understanding of Anaxagoras," and lays most of the blame for the universal misunderstanding of Anaxagoras before Tannery "to the distorting medium of the Aristotelian transmission." "We have here just another instance of [Aristotle's] constitutional incapacity to respect the logic of a set of categories which cut across his own." In a passage distinguished for its confusions and distortion (p. 53) Vlastos attacks Aristotle's exposition as worthless, demonstrably contradictory, and confused.

Vlastos' own interpretation—essentially a combination of the views of Tannery, Burnet, and Peck (*qq.v.*), and very similar to that of Rivaud (*q.v.*)—is offered as just a hypothetical reconstruction of what Anaxagoras *could* have meant; for Anaxagoras could not have been at all clear about his theory in his book, since Aristotle (sic!), Simplicius (sic!), and others "were not so stupid or so dishonest as to disregard a plain statement in the text which ran counter to their own interpretations."

Matter is made up of seeds which are in turn made up of the "traditional" opposites. In the "traditional" view (held generally in presocratic philosophy and science, according to Vlastos) the opposites "are conceived not as abstract Aristotelian predicates, but as substantial 'quality things' or, better still, as forms of energy or 'power' (*dynamis*)" which actually have *power* to affect an organism. These "powers" are not mentioned by later writers in connection with Anaxagoras because Aristotle ignored their presence in his distorted account, and later writers followed suit.

The powers form compounds by combining in various proportions to form seeds (see PECK). These seeds *must* be compounds because "this . . . is the essence of the contemporary concept of the seed, and is especially borne out by Anaxagoras' own account of the seed." There are seeds of *all* things, and indeed the concept of a seed as a basic building block of matter is new with Anaxagoras, though "seed" meant for him what it meant for his contemporaries, "a compound of all the essential constituents of the parent body from which it comes and of the new organism into which it will grow." One of the great differences between Anaxagoras and his predecessors is that he did not limit "being" to only a few things, but held that *all* things have "Parmenidean being"; that this "being" is the "common possession of all things . . . is the revolutionary principle of his physics."

How can the finite contain the infinite? How can all things be in all things (i.e. how can all the infinite powers be in all things)? "Here we are forced to take account of the second major innovation of Anaxagoras' physics . . .: the concept of the infinitely small" which solved this problem, and which also gave Anaxagoras the ability to work with more complex ratios than did Empedocles or others. Indeed the same concept of the infinitely small enabled Anaxagoras to conceive "a third idea: the absolute homogeneity of a given thing with any of its parts, however small." For any part of something has the same ratio of powers as the whole; but at the same time the infinitesimal structure enables you to extract from any part a smaller seed of any other substance: "Any bit of matter . . . contains not only all the powers, but also all the seeds." This is possible since a seed of flesh, for example, contains all the infinite powers in a certain proportion. Therefore a smaller seed of any other substance—e.g. gold—which contains the same powers in different proportions can be extracted from the flesh—leaving over, to be sure, some extra powers which have not been used. From the gold in turn smaller seeds of any other substance—e.g. flesh—can be extracted, and so on *ad infinitum*, each extraction leaving over unused powers and giving rise to smaller seeds.

Thus Anaxagoras' theory of matter is based on the traditional idea of "powers" and the original concept of "seed," ideas combined through "his own unique principle of the physical reality of the infinitely small, which enables him to conserve yet transform the traditional notion of mixture and propound a new, continuous view of nature . . . There is an infinite variety of seed, since there is an infinite variety of ratios in which the powers may be combined. Every seed has *being;* no seed can be generated or destroyed."

H. J. KRAUS, H. SCHMIDT, and W. KRANZ (63), *A New Hesiod Fragment* (1952): Diller's conclusions of twenty years earlier (*q.v.*) are reached again on firmer grounds, according to the authors, who announce themselves as being a Hebrew scholar, an astronomer, and a classicist joined forces for this enterprise; Anaxagoras' fragment 20 of Diels-Kranz (37) is taken to be a fragment of Hesiod.

A. G. VAN MELSEN (104), *From Atomos to Atom* (p. 24) (1960; first ed. 1952): A standard account. The author finds Anaxagoras' theory most arbitrary—more so than the theories of Empedocles and Democritus, and less supported by experimental evidence.

J. A. DAVISON (31), *Protagoras, Democritus, and Anaxagoras* (1953): This article is a new attempt to study the chronology of Anaxagoras' life based on the standard collection of sources; Davison also indulges in considerable conjecture (e.g. maybe the charge of Medism brought against Anaxagoras is due to his having been a Persian conscript!). The main point is the revival of the thesis that all the accounts can be taken to be more or less true if only *two* trials are assumed for Anaxagoras (the solution offered by Hemsen and Carus—*qq.v.*—neither of whom is mentioned by Davison, who makes new modifications in detail).

B. FARRINGTON (42), *Greek Science* (1953): A standard account. Farrington emphasizes Anaxagoras' awareness that there are processes too subtle for the senses to detect, though "there can be no question but that he regarded sense-evidence as indispensable for the investigation of nature."

K. FREEMAN (46), *The Pre-Socratic Philosophers* (p. 261) (1953); (47), *Ancilla to the Pre-Socratic Philosophers* (p. 82) (1957): These two books are essentially translations into English of Diels-Kranz' standard collection of sources and so-called fragments, respectively. Miss Freeman has added a few comments of her own, and, in the first volume, taken some liberty in arranging and juxtaposing the subject matter.

J. E. RAVEN (82), *The Basis of Anaxagoras' Cosmology* (1954): Raven begins by noting the divergence of modern accounts, which have little in common except "undue complication." Raven finds Anaxagoras' system to be much simpler than is usually assumed, and to be based essentially on a reaction to the Eleatics; e.g. the first so-called fragment is taken to be a thorough rejection of Parmenides.

Much of Raven's account is a revival (in the circle of presocratic scholars) of the standard account, which "allows Anaxagoras to mean just what he says."

The basic elements of Anaxagoras' theory of matter were the *moirai* (portions), pieces of opposites, of the 'four' elements, and of everything else, all of which are contained in all things. "What Anaxagoras is doing is of course, as is widely acknowledged, to apply to physical matter the arguments that had earlier been employed by Zeno in connection with mathematical magnitude." The atomists had taken one way out of Zeno's paradox: they simply said that real bodies are *not* ideal geometrical bodies and hence are *not* continua. Anaxagoras took the other way, saying that physical matter, like geometrical magnitude, is infinitely divisible. No matter how far you subdivide a body, you still find a *moira* of all things in what remains. This then is *not* a theory of mixture created by the juxtaposition of particles; such a concept is wholly inapplicable. "That such a theory cannot accurately be described as a theory of fusion can hardly need arguing." One cannot use the term 'particle' in connection with the *moirai*, since there are no indivisible minima; "his *moirai* are so infinitesimally small as to possess virtually (though not, as I have said, actually) no magnitude at all." The very word *moirai* was picked since it "had not too blatantly corporeal an implication"—the *moirai* being so small that they do not even exist in practice. Indeed there is no analogy to *moirai* in everyday experience: the closest analogy is that suggested by Zeno in geometry, namely, the infinite number of points that can be found on any line segment, no matter how small; but there are two basic differences: points have no magnitude and are all alike, while the *moirai* always have some magnitude and are infinitely varied.

In addition to the *moirai* there exist *spermata* (seeds) which are the simplest units into which *moirai* tend to congregate and out of which the world is built (compare BURNET and RIVAUD, and also PECK). The "*sperma* is, as a *moira* is not, something not altogether unlike a particle in the true sense." These *spermata* are the homoeomeries, and the fact that everything contains a portion of everything else and to that extent resembles everything else makes the name 'homoeomeries' appropriate.

The role of the 'opposites' in the mixture is interesting. They are on the one hand no more than a favorite illustration (one more readily accepted by the hearer than others) of the statement that all things are eternally inseparable. In addition however these opposites were quality-things which had the power to effect all sorts of things (see VLASTOS). While being *moirai* among other *moirai* in the *spermata*, the 'opposites' also served a second purpose—that of being active agents in the cosmogony. After Mind imparted the initial motion, the 'opposites' were responsible for the early emergence of the Empedoclean elements and for the separation which took place in the cosmogony. Thus, though "in the last analysis there is only one agent, namely *nous*" which alone "works with a conscious knowledge and purpose," there exist in addition the 'opposites,' which "blindly and unconsciously obey those two axiomatic laws, the attraction of like to like, and the tendency of the heavy to the centre and of the light to the circumference."

In this way Raven discerns a threefold hierarchy in the cosmology. First there is *nous*, "owing its conscious power to its purity." Second there are the 'opposites', which are just as corporeal as substances, but more or less prior since they are responsible for the early stages of the cosmogony, causing the *spermata* to gravitate to particular parts of the world. Finally there are the natural substances, inferior since they "become operative" (by participating themselves in like-to-like attraction; compare REY) in a later stage of the cosmogony. Raven finds in this hierarchy at least the beginnings of distinctions between object and predicate, matter and non-matter; at least *some* awareness of "the metaphysical distinction between courage and cheese" (sic!).

G. S. KIRK and J. E. RAVEN (62), *Chap. 15: Anaxagoras of Clazomenae* (p. 362) (1957): The account here essentially repeats the interpretation of Raven given in the immediately preceding entry. It begins with a discussion of dating, and of the writings of Anaxagoras. The authors include a calculation (based on a common erroneous interpretation of source 1, which they take to mean that Anaxagoras' book sold for a drachma in Socrates' time) of the length of Anaxagoras' book, concluding that the so-called fragments comprise one-eighth of the entire work! Of Anaxagoras they say, "No presocratic philosopher has given rise to more dispute, or been more variously interpreted"; his system must be viewed as "to a large extent a conscious reaction to the theories of his predecessors."

C. DIANO (36), *The Date of Publication of Anaxagoras'* SYNGRAPHE (1955): Diano presents a long argument for taking *syngraphē* to mean prose writing, and interprets the ancient tradition that Anaxagoras was the first to publish a book to mean that Anaxagoras was first to publish a work in prose (in the year 458 B.C.E., according to the author). The article contains a discussion of Anaxagoras' chronology based on the standard sources.

N. BOUSSOULAS (11), *Essay on the Structure of the Mixture in Presocratic Thought:* NOUS *and the Mixture in Anaxagoras' System* (1956): Boussoulas finds that Anaxagoras was not a real dualist (since after all he was under the influence of Parmenides); rather, *nous* and the mixture represent two aspects of the same single real universe: *nous*, which is material (and comparable to Heraclitus' fire, or better yet to Aeschylus' Promethean fire), represents "boundedness" ("la limité"), while "the primitive mass of *chrēmata*" ("la masse primitive des *chrēmata*") represents "unboundedness" ("l'illimité"). Both Mind and the mixture are "One-Existents" ("l'Etre-Un") in the Parmenidean sense, so that basically both have the same nature.

Now the unlimited nature of the mixture resides in its fluctuation between infinite bounds, between the infinitely large and infinitely small: the mixture can become infinitely small, shrinking to a universe-containing atom, or infinitely large. The mass of matter is capable of existing as both extremes, and it actually moves in both directions all the time. In fact, the mass originally underwent ceaseless motion, expanding and contracting in all its parts between an infinitesimal atom and an infinitely large, infinitely rare extension.

Mind on the other hand is separate from the mixture and capable of arresting this motion. Originally it was immobile, but suddenly—at a time when the mixture was in its infinitesimal-atom stage all wrapped in an infinitely small seed, and Mind was occupying the rest of infinitely large empty space—Mind started to move and gave the mixture a huge knock, ordering it. Mind entered the tiny seed of the future cosmos, animated it, and created the world with the aid of movement that gave rise to separation and dissociation. Thus the first stage was union, the second stage dissociation. The third stage was again one of conjunction, where things came together and gave rise to the objects in the world. Finally another stage of dissociation sets in, which witnesses the disintegration of all things and the destruction of the world. The cycle (sic!) thus ends and can resume again. And the entire cycle takes place starting from an infinite number of points all over, so that an infinite number of universes are formed, since each part of the universe, itself containing an infinity, can serve as the matrix for the universe as a whole.

There is much more of the same in the article.

C. MUGLER (75), *The Problem of Anaxagoras* (1956): This article is an extended fantasy in the style of science-fiction writing, on the theory of Anaxagoras. It comprises an answer to the author's question, "Where is the truth about Anaxagoras?" ("Où est la vérité d'Anaxagore?"). Anaxagoras' work is viewed specifically as a reaction to Leucippus and the atomists; it is an attempt to answer the basic problem of the time, namely, how does the world maintain itself against wear, and what is the mechanism for energy balance? Mugler's account of Anaxagoras' theory of matter is very similar to that of Tannery and Rivaud (*qq.v.*).

Anaxagoras held that there was one finite world infinitely subdivisible into smaller pieces. This infinite divisibility is what accounts for the inexhaustibility of the universe; the resources of the universe are inexhaustible because the properties of matter are infinitely divisible, and there are untold "reserves of energy stored in the infinitesimal structures" ("des réserves d'énergie emmagasinées dans la structure infinitésimale"). "Having discovered then the inexhaustible source of energy (which is inextricably bound to matter) which the world needs in order to go on, in the infinitesimal structure of matter, Anaxagoras could deny that the original undifferentiated mass was infinitely large" (*sc.* since he did not require infinite size in order to provide an inexhaustible source of energy) ("Ayant ainsi découvert la source inépuisable d'énergie, dont un cosmos a besoin pour durer, dans la structure infinitésimale de la matière, . . . Anaxagore pouvait renoncer à l'infiniment grand pour les dimensions de la masse primordiale indifférenciée."). Indeed Anaxagoras' Principle of Indifference also made it necessary to assume a finite universe since an infinite universe would have no center for the earth to occupy.

Mind is a fine material mixed with the primordial mixture; it is like a perfect gas. Originally it was compressed in an infinitesimally small volume, but it gradually spreads and releases the energy stored in the mixture by differentiating the mixture. Mind's force thus spreads as the Mind-stuff spreads, and the force diminishes as the front of expanding Mind-stuff advances; in fact the force decreases as $1/r^2$ since the area over which it is spread increases as r^2. The Mind-stuff spreads with a decreasing radial velocity. It is a major problem in interpreting the theory to determine whether or not the Mind-stuff ever reaches the outer limits of the mass. Mugler thinks that it does not, but that it approaches it ever more closely and that it only asymptotically fills the whole volume of matter; in this way the energy necessary for the continuation of the universe's eternal functioning—which as we have seen comes from the differentiation of matter—will never cease to be released from the layer bounding the ever-expanding Mind-stuff (as well as from the matter already permeated by Mind, which Mind continues to differentiate).

Since the world has no end, it could logically have had no beginning either. By reintegrating the process of differentiation from its present point of advancement we can project back into the past. This yields the picture that as you go back in time Mind-stuff occupied ever smaller volumes, approaching—but never reaching—the size of a point in the infinite past. Since the extent of Mind-stuff is identical with the extent of the actual world at any given instant, the entire world—complete to every detail—must have been smaller and smaller as we go back in time. This is Anaxagoras' most daring conception: a complete relativism, so that any object is in itself both large and small (depending on when you look at it).

Crucial to Mugler's argument, as he sees it, is the realization that in order for there to be asymptotic behavior as you go backward and forward in time, the differentiation must *not* be assumed to proceed as a geometric progression (i.e. you must not assume that the time it takes to separate out a certain amount of a property is proportional to the amount of property separated), since then—as was known in Zeno's time—the infinite steps of the progression would be completed in a finite time. One must assume a different law—e.g. that it always takes the *same* amount of time to *halve* the amount of a property present, regardless of how much of the property there is—so that you get a process which really spans an infinite time. Mugler gives some formulas as possible examples of the law of variation actually used in Anaxagoras' theory.

Since we do not know the actual extent of the mixture or the stage of development we are in—i.e. how much undifferentiated matter still lies beyond the outer limit of Mind—we have no idea what the final state of the world will be like. Anaxagoras did however notice that as time goes on more and more water is separated out, and he envisioned a gradual flooding of the world (see in Diogenes Laertius' account, source 340, the reply of Anaxagoras to the man of Lampsacus), though our state of ignorance as to how much water is still left in the undifferentiated mass made it impossible for Anaxagoras to determine whether the entire world would actually be engulfed.

Mind's main action is to cause like to come to like in some manner. It does this not by administering a mechanical push, but by exerting an action at a distance—a concept Anaxagoras doubtless picked up, according to Mugler, from his studies of electricity and magnetism. We see then that Anaxagoras' theory had much in common with modern theories of magnetism and of energy.

Mind's action is not exclusively spherically symmetric, since if it were, specific objects could never be formed. Its second function of fashioning everyday things comes about through perturbations of the spherical symmetry, of the kind which one might imagine would bring about the desired results. We have few details on such points but we can imagine that Mind had a hand in all kinds of things, especially in forming living beings, which are distinguished in the theory by greater economy in processes of energy transformation, and by a less rapid increase in entropy.

Anaxagoras' theory of thermodynamics, though surely interesting, is unfortunately unknown. But we do know, from his theory of the formation of winds and of the incandescence of stars because of the heating caused by motional friction, that Anaxagoras dealt with mutual transformations of heat and motion.

S. SAMBURSKY (90), *The Physical World of the Greeks* (1956): There is in this book a fairly standard account of Anaxagoras' particular theories. Sambursky thinks that Mind is "a physical substance in essence" (p. 82), and that Anaxagoras' theory of matter was a continuum theory with 'seeds' (p. 23). The author points out that Anaxagoras did not distinguish between terrestrial and celestial physics, but believed that the same laws applied in both regions, and that the same substances were found in both regions (p. 24).

R. MATHEWSON (70), *Aristotle and Anaxagoras: An Examination of F. M. Cornford's Interpretation* (1958): This masterful article is a thoroughgoing attack on Cornford's work, in particular on his use of evidence and on his method of investigation (rather than on all Cornford's assumptions, many of which—even debatable ones—are granted for the sake of the main argument). The refutation will not be outlined here; but it is well worth reading as an example of careful analysis and argumentation.

Mathewson thinks that though Aristotle often disregards the historical setting of his predecessors and finds in them elements they did not possess, still the evidence of his testimony should not be disregarded without compelling reasons and without first understanding him. As for Lucretius, whom Cornford (*q.v.*) used as his primary source, Mathewson feels that he is untrustworthy and never to be preferred to Aristotle: "what Lucretius (a Roman, a poet, and an Epicurean) may say or imply is not compelling" (p. 77). "Looking at the account [of Lucretius] as a whole I feel doubtful whether Lucretius had any very clear notion of what Anaxagoras' theory was" (Note 2, p. 81).

K. BLOCH (10), *Anaxagoras and Atomic Theory* (1959): According to Bloch all the details of Anaxagoras' theory are unimportant compared to the main point that Anaxagoras is closely linked to Parmenides and the Eleatics, i.e. that he believes that Being is one, is continuous, and is all things *actually* together. As a physicist Anaxagoras was an atomist who believed in infinitesimal atoms, but his homoeomery theory is in fact worthless. His real value consisted in the fact that he was a metaphysician with an Eleatic point of view. Bloch's article goes on to concentrate on Anaxagoras' ontology in light of this new evaluation, which he claims was never before understood except in the Middle Ages.

Among other things we learn that Anaxagoras saw two types of division and differentiation in the world: one, a division into individual forms (not cut off from one another), and a second (where

Anaxagoras differs from the atomists), into infinitesimals which maintain their individuality but have *no gaps* between them, so that they form one continuous Being with no non-Being in it.

H. DIELS and W. KRANZ (37), *Fragments of the Presocratics* (Vol. II, Section 59: *Anaxagoras*) (1960; Ninth edition of a work first published by H. Diels in 1903): This standard handbook contains a standard collection of sources and of the so-called fragments. We have commented on this book in the Preface.

M. E. REESOR (84), *The Meaning of Anaxagoras* (1960): This article is so fuzzy and unclear that it is virtually impossible to understand the meaning of Miss Reesor, let alone the meaning of Anaxagoras. Miss Reesor spends much of her effort arguing against Aristotle's account ("as a criticism of Anaxagoras Aristotle's comments are worthless"; etc.), and most of her article is taken up in a discussion of the implications of the words 'everything is in everything', which "seem to have meant that every entity was in every other entity."

B. L. VAN DER WAERDEN (103), *Science Awakening* (esp. p. 128) (1961): In his preface (p. 6) the author appeals for a return to original sources (instead of reliance on secondary ones). His report of Anaxagoras' theories is based especially on the Origen(Hippolytus?) account. It has been impossible, however, to determine the source of the statement, "Anaxagoras and Democritus held that the sun and the moon were not living beings, but inert rocks, tossed to and fro in the whirl of the atoms" (p. 106); or of the statement that Anaxagoras reasoned that the planets and the moon are nearer to the earth and hence are dragged along less rapidly than the stars. In any case the author feels that Anaxagoras' astronomy is sterile.

Bibliography of the Ancient Sources

AELIAN

On the Characteristics of Animals, trans. and ed. A. F. Scholfield, 3 Vols.; Cambridge, Mass., 1959.

Claudii Aeliani De Natura Animalium Libri XVII, ed. Rudolph Hercher; Leipzig, 1864 (BT).

Claudii Aeliani Varia Historia, ed. Rudolph Hercher; Leipzig, 1870 (BT).

ALEXANDER OF APHRODISIAS

In Aristotelis Meteorologicorum Libros, ed. Michael Hayduck; Berlin, 1899 (Commentaria In Aristotelem Graeca, III^{2}).

In Librum De Sensu, ed. Paul Wendland; Berlin, 1901 (Commentaria In Aristotelem Graeca, III^{1}).

In Aristotelis Metaphysica, ed. Michael Hayduck; Berlin, 1891 (Commentaria In Aristotelem Graeca, I).

Praeter Commentaria Scripta Minora, ed. Ivo Bruns; Berlin, 1892 (Supplementum Aristotelicum, II^{2}).

AMMIANUS MARCELLINUS

Ammianus Marcellinus, trans. John C. Rolfe; Cambridge, Mass.; Vol. I, 1935; Vol. II, 1937 (LCL).

Rerum Gestarum (Libri Qui Supersunt), ed. Carl U. Clark, 2 Vols.; Berlin, 1910.

APULEIUS

Opera Quae Supersunt: Vol. 2, Fasc. 1 Pro Se de Magia Liber (*Apologia*), ed. Rudolph Helm; Leipzig, 1959 (BT).

ARISTIDES (AELIUS ARISTIDES)

Opera, ed. Wilhelm Dindorf; Leipzig, 1829.

ARISTOTLE

Aristoteles Opera, ed. Immanuel Bekker, rev. Olof Gigon, 2 Vols.; Berlin, 1960^{2}.

Aristotle's Physics, trans. Richard Hope; Nebraska, 1961.

The Physics, trans. Philip M. Wicksteed and Francis M. Cornford, 2 Vols.; Cambridge, Mass., 1957^{2} (LCL).

Physica, ed. W. D. Ross; Oxford, 1960, corrected printing of 1950 ed. (OCT).

Aristotle's Physics, text and commentary by W. D. Ross; Oxford, 1936.

Physica, trans. R. P. Hardie and R. K. Gaye; Oxford, 1930 (The Works of Aristotle, trans. into English, ed. W. D. Ross, Vol. II).

Aristoteles Acht Buecher Physik, trans. and notes by Carl Prantl; Leipzig, 1854 (Aristoteles' Werke, Griechisch und Deutsch, Vol. I).

On the Heavens, trans. W. K. C. Guthrie; Cambridge, Mass., 1939 (LCL).

De Caelo, ed. D. J. Allan; Oxford, 1936 (OCT).

De Caelo, trans. J. L. Stocks; Oxford, 1930 (The Works of Aristotle, trans. into English, ed. W. D. Ross, Vol. II).

De Caelo, ed. Carl Prantl; Leipzig, 1881 (BT).

On Sophistical Refutations. On Coming-to-be and Passing-away, text and trans. E. S. Forster, *On the Cosmos*, text and trans. D. J. Furley; Cambridge, Mass., 1955 (LCL).

De Generatione et Corruptione, trans. H. H. Joachim; Oxford, 1930 (The Works of Aristotle, trans. into English, ed. W. D. Ross, Vol. II).

Meteorologica, trans. E. W. Webster; Oxford, 1931 (The Works of Aristotle, trans. into English, ed. W. D. Ross, Vol. III).

Meteorologicorum Libri Quattuor, ed. F. H. Fobes; Cambridge, Mass., 1919.

De Anima, ed. W. D. Ross; Oxford, 1956 (OCT).

De Anima, trans. J. A. Smith; Oxford, 1931 (The Works of Aristotle, trans. into English, ed. W. D. Ross, Vol. III).

Petits Traités d'Histoire Naturelle, ed. and trans. René Mugnier; Paris, 1953 (Budé).

De Respiratione, trans. G. R. T. Ross; Oxford, 1908 (The Works of Aristotle, trans. into English, ed. W. D. Ross, Vol. III).

Les Parties des Animaux, ed. and trans. P. Louis; Paris, 1956 (Budé).

De Partibus Animalium, trans. William Ogle; Oxford, 1912 (The Works of Aristotle, trans. into English, ed. J. A. Smith and W. D. Ross, Vol. V).

Generation of Animals, text and trans. A. L. Peck; Cambridge, Mass., 1953 (LCL).

De Generatione Animalium, trans. Arthur Platt; Oxford, 1912 (The Works of Aristotle, trans. into English, ed. J. A. Smith and W. D. Ross, Vol. V).

Minor Works: On Colours. On Things Heard. Physiognomics. On Plants. On Marvellous Things Heard. Mechanical Problems. On Indivisible Lines. Situations and Names of Winds. On Melissus Xenophanes and Gorgias, text and trans. W. S. Hett; Cambridge, Mass., 1936 (LCL).

De Plantis, trans. E. S. Forster; Oxford, 1913 (The Works of Aristotle, trans. into English, ed. W. D. Ross, Vol. VI).

Nicolai Damasceni De Plantis Libri Duo Aristoteli Vulgo Adscripti; Ex Isaaci Ben Honain Versione Arabica Latine Vertit Alfredus, ed. E. H. F. Meyer; Leipzig, 1841.

De Melisso Xenophane Gorgia, trans. T. Loveday and E. S. Forster; Oxford, 1913 (The Works of Aristotle, trans. into English, ed. W. D. Ross, Vol. VI).

Problems I Bks I–XXI, text and trans. W. S. Hett; Cambridge, Mass., 1936 (LCL).

Problemata, trans. E. S. Forster; Oxford, 1927 (The Works of Aristotle, trans. into English, ed. W. D. Ross, Vol. VII).

Metaphysica, ed. W. Jaeger; Oxford, 1957 (OCT).

Metaphysics, trans. Richard Hope; New York, 1952.

Aristoteles Metaphysik, trans. into German and comm. Eugen Rolfes; Leipzig, 1928.

Metaphysica, trans. W. D. Ross; Oxford, 1928^2 (The Works of Aristotle, trans. into English, ed. W. D. Ross, Vol. VIII).

Metaphysics, trans. ed. and comm. W. D. Ross, 2 Vols.; Oxford, 1924.

Ethica Nicomachea, ed. I. Bywater; Oxford, 1957, first published 1894 (OCT).

Ethica Nicomachea, trans. W. D. Ross; Oxford, 1925 (The Works of Aristotle, trans. into English, ed. W. D. Ross, Vol. IX).

Ethica Eudemia, ed. F. Susemihl; Leipzig, 1884 (BT).

Ethica Eudemia, trans. J. Solomon; Oxford, 1925 (The Works of Aristotle, trans. into English, ed. W. D. Ross, Vol. IX).

Ars Rhetorica, ed. W. D. Ross; Oxford, 1959 (OCT).

Rhetorica, trans. W. Rhys Roberts; Oxford, 1924 (?) (The Works of Aristotle, trans. into English, ed. W. D. Ross, Vol. XI).

Aristotelis Qui Ferebantur Librorum Fragmenta, Valentine Rose; Leipzig, 1886 (BT).

ASCLEPIUS

In Aristotelis Metaphysicorum Libros A–Z, ed. Michael Hayduck; Berlin, 1888 (Commentaria In Aristotelem Graeca, Vol. VI^2).

ASPASIUS

In Ethica Nicomachea quae supersunt commentaria, ed. Gustav Heylbut; Berlin, 1889 (Commentaria In Aristotelem Graeca, XIX^1).

ATHENAEUS

Athénée de Naucratis: Les Deipnosophistes Livre I et II, ed. and trans. A. M. Desrousseaux and Charles Astruc; Paris, 1956.

The Deipnosophists, trans. Charles Burton Gulick, 7 Vols.; Cambridge, Mass., 1941 (LCL).

Athenaeii Naucratitae Dipnosophistarum Libri XV, ed. G. Kaibel, 3 Vols.; Leipzig, 1887, 1890.

Athenaeus, ed. Wilhelm Dindorf; Leipzig, 1827.

AUGUSTINE

Aurelii Augustini De Civitate Dei Libri 1–22, 2 Vols.; Turnhout, 1955 (Nos. 47 and 48 in Corpus Christianorum [Series Latina]: Aurelii Augustini Opera, pars. 14).

Aurelii Augustini De Civitate Dei Libri XXII, ed. A. Kalb from the 4th edition of B. Dombart, 2 Vols.; Leipzig, 1927 (BT).

De Civitate Dei; Paris, 1864 (Patrologiae Latinae, ed. Migne, Vol. 41).

Aureli Augustini Operum Sectio II: Augustini Epistulae, ed. A. Goldbacher; Leipzig, 1895 (Corpus Scriptorum Ecclesiasticorum Latinorum, Vol. 34^1).

Aurelius Augustinus: Epistolae (Classis II) (396–410 C.E.); Paris, 1865 (Patrologiae Latinae, ed. Migne, Vol. 33).

Contra Julianum Pelagianum; Paris, 1865 (Patrologiae Latinae ed. Migne, Vol. 44).

BOETHIUS

Anicii Manlii Severini Boethii Philosophiae Consolatio; Turnhout, 1957 (No. 94 in Corpus Christianorum [Series Latina], Anicii Manlii Severini Boethii Opera, pars. I).

De Consolatione Philosophiae; Paris, 1860 (Patrologiae Latinae, ed. Migne, Vol. 63).

CENSORINUS

De Die Natali Liber, ed. Frederic Hultoch; Leipzig, 1867 (BT).

CHALCIDIUS

Platonis Timaeus Interprete Chalcidio cum Eiusdem Commentario, ed. J. Wrobel; Leipzig, 1876 (BT).

V. C. Chalcidius: Timaeus de Platonis Translatus, ed. Johannes Meurs; Leiden, 1617.

CICERO

M. Tullius Cicero: De Natura Deorum, ed. W. Ax (post O. Plasberg); Stuttgart, 1961 (BT).

De Natura Deorum, ed. Arthur S. Pease; Cambridge, Mass., 1955–58.

De Natura Deorum; Academica, ed. and trans. H. Rackham; New York, 1933 (LCL).

M. Tullius Cicero: Academicorum Reliquiae, ed. O. Plasberg; Stuttgart, 1961 (BT).

Cicéron: Tusculanes, ed. Georges Fohlen, trans. Jules Humbert, 2 Vols.; Paris, 1931 (Budé).

Marcus Tullius Cicero: Tusculanae Disputationes, ed. C. F. W. Mueller; Leipzig, 1888 (BT).

Marcus Tullius Cicero: Rhetorica, ed. A. S. Wilkins, 2 Vols.; Oxford, 1901–03 (OCT).

Cicéron: Brutus, ed. and trans. Jules Martha; Paris, 1923 (Budé).

Cicero: De Oratore, trans. H. Rackham, 2 Vols.; Cambridge, Mass., 1942 (LCL).

CLEMENT OF ALEXANDRIA

Clemens Alexandrinus, Vol. II: Stromata I–VI, ed. Ludwig Fruechtel after Otto Staehlin; Berlin, 1960^3.

Clemens Alexandrinus, Vol. III: Stromata Buch VII und VIII. Excerpta ex Theodoto. Eclogae Propheticae. Quis Dives Salvetur. Fragmente, ed. O. Staehlin; Leipzig, 1909.

Clemens Alexandrinus: Stromata; Paris, 1857 (Patrologiae Graecae, ed. Migne, Vol. 8).

Clemens Alexandrinus: Cohortatio ad gentes (Protrepticus); Paris, 1857 (Patrologiae Graecae, ed. Migne, Vol. 8).

CLEMENT OF ROME

Recognitiones (in *Clementis I Romani Opera Omnia*); Paris, 1857 (Patrologiae Graecae, ed. Migne, Vol. 1).

CYRIL OF ALEXANDRIA

Cyrillus Alexandrinus: Contra (or *Adversus*) *Julianum;* Paris, 1859 (Patrologiae Graecae, ed. Migne, Vol. 76).

DAMASCIUS

Damascius Diadochus: Dubitationes et Solutiones de Primis Principiis in Platonis Parmenidem, ed. Charles Emile Ruelle, 2 Vols.; Paris, 1889.

DEMOSTHENES

Demosthenes: VII Funeral Speech. Erotic Essay. LX, LXI Exordia. and Letters., ed. Norman W. De Witt and Norman J. De Witt; Cambridge, Mass., 1949 (LCL).

Orationes, ed. Immanuel Bekker; Leipzig, 1854.

DIO CHRYSOSTOM

Dionis Chrysostomi Orationes, ed. Guy de Budé, 2 Vols.; Leipzig, 1916 (BT).

Orationes, ed. Johannes Jacob Reiske; Leipzig, 1798.

DIODORUS OF SICILY

Diodorus of Sicily, trans. C. H. Oldfather, 10 Vols.; New York, 1933 (LCL).

Diodori Bibliotheca Historica, ed. F. Vogel (after L. Dindorf, after I. Bekker); Leipzig, 1888 (BT).

DIOGENES LAERTIUS

Lives of Eminent Philosophers, trans. R. D. Hicks, 2 Vols.; Cambridge, Mass., 1950 (LCL).

DIONYSIUS OF HALICARNASSUS

Opuscula II, ed. Hermann Usener and Ludwig Radermacher; Leipzig, 1904–1929 (BT).

EUSEBIUS

Eusebii Pamphili Evangelicae Praeparationis Libri XV, ed. E. H. Gifford, Vol. 2 (Libri X–XV); Oxford, 1903.

Praeparatio Evangelica; Paris, 1857 (Patrologiae Graecae, ed. Migne, Vol. 21).

Eusebii Pamphili Evangelicae Praeparationis Libri XV, ed. T. Gaisford, 4 Vols.; Oxford, 1843.

Eusebii Pamphili Chronici Canones; Latine Vertit, Adauxit, Ad Sua Tempora Produxit Eusebius Hieronymus, ed. J. K. Fotheringham; London, 1923.

FRONTO

M. Cornelii Frontonis Epistulae I, ed. M. P. J. van den Hout; Leiden, 1954.

The Correspondence of Marcus Cornelius Fronto, ed. and trans. C. R. Haines, 2 Vols.; New York, 1920 (LCL).

GALEN

Galeni Historia Philosopha: in *Doxographi Graeci*, ed. with introd. by H. Diels; Berlin, 1958 (photocopy of first edition 1879).

Commentary on Book 2 of the EPIDEMICS *of Hippocrates*, trans. from the Arabic (using notes of M. Simon) (from the Arabic of Hunain ibn Isḥaq) into German by Franz Pfaff: in *Galeni In Hippocratis.* EPIDEMIARUM LIBROS I ET II, ed. Ernst Wenkebach and Franz Pfaff; Leipzig, 1934 (Corpus Medicorum Graecorum 5.10.1.1).

On the Natural Faculties, ed. and trans. Arthur John Brock; New York, 1916 (LCL).

Galeni De Usu Partium Libri XVII, Vol. I, ed. G. Helmreich; Leipzig, 1907 (BT).

Galeni De Temperamentis Libri III, ed. G. Helmreich; Leipzig, 1904 (BT).

Opera Omnia, ed. D. Carl Gottlob Kuehn: in *Medicorum Graecorum Opera Quae Exstant*; Leipzig, Vol. 3, 1822; Vol. 5, 1823; Vol. 11, 1826; Vol. 19, 1830.

GELLIUS (AULUS GELLIUS)

A. Gellii Noctium Atticarum Libri XX, ed. Carl Hosius post M. Hertz; Leipzig, 1903 (BT).

GREGORY OF NAZIANZUS

Oratio IV: Contra Julianum I; Paris, 1857 (Patrologiae Graecae, ed. Migne, Vol. 35).

HARPOCRATION

Lexicon in Decem Oratores Atticos, ed. Wilhelm Dindorf; Oxford, 1853.

HERMIAS

(Hermias of Alexandria) In Platonis Phaedrum Scholia, ed. P. Couvreur; Paris, 1901 (Bibliothèque de l'école des hautes études; Sciences historiques et philologiques, 133).

Hermias Philosophus: Irrisio gentilium philosophorum; Paris, 1857 (Patrologiae Graecae, ed. Migne, Vol. 6).

Gentilium Philosophorum Irrisio, trans. Raphael Seiler: in *Justini, Philosophi et Martyris, Opera. Item Athenagorae Atheniensis, Theophili Antiocheni, Tatiani Assyrii et Hermiae Philosophi Tractatus Aliquot*; Cologne, 1686.

HERO OF ALEXANDRIA

Opera Quae Supersunt, Vol. 4, ed. J. L. Heiberg; Leipzig, 1912 (BT).

(HIPPOLYTUS: See also Origen)

Refutatio Omnium Haeresium: in *Werke*, Vol. 3, ed. Paul Wendland; Leipzig, 1916 (Die Griechischen Christlichen Schriftsteller der Ersten Drei Jahrhunderte).

IAMBLICHUS

Protrepticus, ed Hermenegildus Pistelli; Leipzig, 1888 (BT).

INSCRIPTIONS

Inscriptiones Insularum Maris Aegaei Praeter Delum, ed. Friedrich Hiller von Gaertringen; Berlin, 1903–1909 (Inscriptiones Graecae 12.5).

Inscriptiones Italiae et Siciliae, ed. Georg Kaibel; Berlin, 1890 (Inscriptiones Graecae 14).

IRENAEUS

Irenaeus Lugdunensis: Contra Haereses; Paris, 1857 (Patrologiae Graecae, ed. Migne, Vol. 7).

ISOCRATES

Oeuvres Complètes, ed. Aimé-Marie-Gaspard de Clermont-Tonnerre; Paris, 1864 (Didot).

JEROME

Eusebii Hieronymi Epistulae, ed. I. Hilberg; Vienna, 1910.

Epistle to Heliodorus; Paris, 1877 (Patrologiae Latinae, ed. Migne, Vol. 22).

JOSEPHUS

The Life. Against Apion (Vol. I of Josephus), trans. and ed. H. St. J. Thackeray; Cambridge, Mass., 1961 (LCL).

JULIAN

The Works of the Emperor Julian, trans. W. C. Wright, 3 Vols.; Cambridge, Mass., 1949 (LCL).

Julianus Imperator: Quae Supersunt Omnia, ed. Friedrich Carl Hertlein; Leipzig, 1875 (BT).

JUSTIN

Cohortatio ad Graecos; Paris, 1857 (Patrologiae Graecae, ed. Migne, Vol. 6).

LACTANTIUS

L. Caeli Firmiani Lactanti Opera Omnia, ed. S. Brandt et G. Laubmann; *Pars. I. Divinae Institutiones et Epitome Divinarum Institutionum,* ed. S. Brandt; Leipzig, 1890 (Corpus Scriptorum Ecclesiasticorum Latinorum, XIX).

Opera, ed. O. Fridoline Fritzsche; Leipzig, 1842.

Opera, ed. A. Thomas Spark; Oxford, 1684.

LIBANIUS

Libanii Opera, ed. Richard Foerster; Leipzig, 1909 (BT).

Praeludia Oratoria LXXII, Declamationes XLV et Dissertationes.

Morales, ed. Frédéric Morel, Vol. 2; Paris, 1606.

LUCIAN

Lucian, trans. and ed. A. M. Harmon, 7 Vols.; New York, 1915 (LCL).

LUCRETIUS

De Rerum Natura, ed. with trans. and comm., Cyril Bailey, 3 Vols.; Oxford, 1950 reprinted from corrected first edition.

LYDUS

Liber De Mensibus, ed. Richard Wuensch; Leipzig, 1898 (BT).

Ioannis Laurentii Lydi Liber de Ostentis et Calendaria Graeca.

Omnia, 2nd ed. Curt Wachsmuth; Leipzig, 1897 (BT).

De Ostensis, ed. Carl Benedict Hase; Paris, 1823.

MARTIANUS CAPELLA

Martianus Capella, ed. A. Dick; Leipzig, 1925 (BT).

Satyricon (De nuptiis Philologiae et Mercurii libri duo), ed. Hug. Grotius; Leyden, 1599.

MAXIMUS OF TYRE

Maximus Tyrius: Philosophumena, ed. H. Hobein; Leipzig, 1910 (BT).

(MIGNE)

Pour Revaloriser Migne, Tables Rectificatives by P. Glorieux; Lille, 1952 (Suppl. to IXième Année, 1952 of Mélanges de Science Religieuse).

MINUCIUS FELIX

Octavius, ed. H. von Geisau; Muenster, 1955.

M. Minucii Felcis Octavius, ed. G. Quispel; Leiden, 1949.

Octavius, ed. Hermann Boenig; Leipzig, 1903 (BT).

(NAUCK)

Tragicorum Graecorum Fragmenta, ed. A. Nauck; Leipzig, 1856.

NEMESIUS

SS. Patrum Aegyptiorum Opera Omnia. Praecedunt Philonis Carpasii, Asterii Amaseni, Nemesii Emeseni, Hieronymi Graeci Scripta Quae Supersunt; Paris, 1858 (Patrologiae Graecae, ed. Migne, Vol. 40).

De Natura Hominis; Oxford, 1671.

OLYMPIODORUS

In Platonis GORGIAM *Commentaria*, ed. William Norvin; Leipzig, 1936.

In Platonis PHAEDONEM *Commentaria*, ed. William Norvin; Leipzig, 1913.

Commentary on the FIRST ALCIBIADES *of Plato*, ed. L. G. Westerink; Amsterdam, 1956.

In Aristotelis METEORA, ed. Wilhelm Stueve; Berlin, 1900 (Commentaria In Aristotelem Graeca, XII²).

ORIGEN

Origenes Werke, ed. P. Koetschau, 2 Vols.; Leipzig, 1899 (Die Griechischen Christlichen Schriftsteller der Ersten Drei Jahrhunderte).

Contra Celsum; Paris, 1857 (Patrologiae Graecae, ed. Migne, vol. 11).

The Oxyrhynchus Papyri, Part IX, ed. Arthur S. Hunt; London, 1912.

PHILO

Philonis Alexandrini Opera Quae Supersunt, Vol. I, ed. L. Cohn; Vol. VI, ed. L. Cohn and S. Reiter; Berlin, 1896 and 1915.

Philo Judaeus: Opera Omnia; Leipzig, 1853.

PHILODEMUS

Adversus (Sophistas), ed. F. Sbordone; Naples, 1947.

Volumina Rhetorica, ed. Siegfried Sudhaus; Leipzig, 1896 (vol. 2) (BT).

"The Rhetorica of Philodemus" (Translation and Commentary), by H. M. Hubbell, in *Transactions of the Connecticut Academy of Arts and Sciences* 23 (1920) 243.

Philoponus, Joannes

In Aristotelis PHYSICORUM LIBROS *Commentaria*, ed. Hieronymus Vitelli, 2 Vols.; Berlin, 1887 (Commentaria In Aristotelem Graeca, XVI, XVII).

In Aristotelis Libros DE GENERATIONE ET CORRUPTIONE *Commentaria*, ed. Hieronymus Vitelli; Berlin, 1897 (Commentaria In Aristotelem Graeca XIV^{2}).

In Aristotelis METEOROLOGICORUM LIBRUM PRIMUM *Commentarium*, ed. Michael Hayduck; Berlin, 1901 (Commentaria In Aristotelem Graeca XIV^{1}).

In Aristotelis DE ANIMA *Libros Commentaria*, ed. Michael Hayduck; Berlin, 1897 (Commentaria In Aristotelem Graeca, XV).

De Opificio Mundi, ed. Walter Reichardt; Leipzig, 1897 (BT).

De Aeternitate Mundi, Contra Proclum, ed. Hugo Rabe; Leipzig, 1899 (BT).

Philostratus

The Life of Apollonius of Tyana, ed. and trans. F. C. Conybeare, 2 Vols.; New York, 1912 (LCL).

Philostratus and Eunapius: The Lives of the Sophists, trans. W. C. Wright; New York, 1932 (LCL).

Plato

Platonis Opera, ed. John Burnet, 6 Vols.; Oxford, 1900.

Pliny the Elder

Natural History, ed. and trans. H. Rackham (Vol. 1 of 10); Cambridge, Mass., 1938 (LCL).

Pline L'Ancien: Histoire Naturelle (Vols. I, II), ed., trans. and comm. Jean Beaujeu; Paris, 1950 (Budé).

Plotinus

Plotini Opera: I Enneades I–III; II Enneades IV–V, ed. Paul Henry, and Hans-Rudolph Schwyzer; Paris, 1951/1959.

Enneades, ed. and trans. into French by Emile Bréhier; Paris, vol. 2, 1956^{2}; vol. 5, 1931 (Budé).

Plutarch

Moralia: Vol. I, ed. W. R. Paton, and I. Wegenhaupt; Leipzig, 1925 (BT).

Moralia: Vol. *II*, ed. W. Nachstaedt, W. Sieveking, J. B. Titchener; Leipzig, 1935 (BT).

Moralia: Vol. *III*, ed. W. R. Paton, M. Pohlenz, W. Sieveking; Leipzig, 1929 (BT).

Moralia: Vol. *IV*, ed. C. Hubert; Leipzig, 1938 (BT).

Moralia: Vol. V *Fasc.* 1, ed. C. Hubert; Leipzig, 1957 (BT).

Moralia: Vol. VI *Fasc.* 1, ed. C. Hubert; Leipzig, 1954 (BT).

Moralia, ed. Gregory N. Bernardakis, 7 Vols.; Leipzig, 1893 (BT).

Lives, ed. and trans. Bernadotte Perrin, 11 Vols.; Cambridge, Mass., 1916 (LCL).

Plutarchus' Leven van Lysander, ed. with commentary by J. Smits; Amsterdam, 1939.

PROBUS

Appendix Serviana: in *Servii Grammatici qui Feruntur in Vergilii Carmina Commentarii*, ed. George Thilo and Hermann Hagen, Vol. 3^2, ed. H. Hagen; Leipzig, 1902.

PROCLUS

Proclus Diadochus: Commentary on the FIRST ALCIBIADES *of Plato*, ed. L. G. Westernik; Amsterdam, 1954.

Proclus Diadochus: In Primum Euclidis ELEMENTORUM *Librum Commentarii*, ed. Gottfried Friedlein; Leipzig, 1873 (BT).

Procli Philosophi Platonici Opera Inedita, ed. Victor Cousin; Paris, 1864.

Commentarius in Platonis TIMAEUM, ed. C. E. Chr. Schneider; Bratislava, 1847.

QUINTILIAN

M. Fabi Quintiliani Institutionis Oratoriae Libri XII, ed. L. Radermacher, *Vol. II* (*Libros VII–XII Continens*); Leipzig, 1935 (BT).

Institutionis Oratoriae (Libri Duodecim), ed. Carl Halm, 2 Vols.; Leipzig, 1878 (BT).

SENECA

Sénèque: Questions Naturelles, ed. and trans. Paul Oltramare; Paris, 1929 (Budé).

Lucius Annaeus Seneca: Opera Omnia; Vol. 5, *Naturales Quaestiones*; Leipzig, 1869.

SERVIUS

Servius Grammaticus: In Vergilii Carmina Commentarii, Vol. 1 *(Aeneid I–V)*, ed. George Thilo; Leipzig, 1923.

SEXTUS EMPIRICUS

Sexti Empirici Opera, vol. 3 (Adv. Mathem. I–VI), ed. J. Mau; *Indices ad vol. I–III*, K. Janáček; Leipzig, 1954 (BT).

Sextus Empiricus, trans. R. G. Bury, 3 vols.; London, 1933 (LCL).

Sexti Empirici Opera. Vol. 2 (Adv. Mathem. VII–XI), ed. H. Mutschmann; Leipzig, 1914 (BT).

Opera (Graeca et Latine), ed. Jo. Albert Fabricius, 2 Vols.; Leipzig, 1862.

SIDONIUS APOLLINARIS

Sidoine Apollinaire: Tome I, Poèmes, ed. and trans. André Loyen; Paris, 1960 (Budé).

Caius Sollius Apollinaris, ed. Paul Mohr; Leipzig, 1895 (BT).

SIMPLICIUS

Simplicii. In Libros Aristotelis PHYSICORUM *Commentaria*, ed. Hermann Diels, 2 Vols.; Berlin, 1882 (Commentaria In Aristotelem Graeca IX, X).

Simplicii. In Aristotelis DE CAELO *Commentaria*, ed. I. L. Heiberg; Berlin, 1894 (Commentaria In Aristotelem Graeca, VII).

Simplicii. In Libros Aristotelis DE ANIMA *Commentaria*, ed. Michael Hayduck; Berlin, 1882 (Commentaria In Aristotelem Graeca, XI).

In Epicteti ENCHIRIDION, in: *Theophrasti Characteres, Marci Antonini Commentarii, etc.*, ed. F. Duebner; Paris, 1840.

SOLINUS

Caius Julius Solinus: Collectanea Rerum Memorabilium, ed. Th. Mommsen; Berlin, 1958, offset from 1895 edn.

STOBAEUS

Ioannis Stobaei Anthologium, ed. C. Wachsmuth et O. Hense, 5 Vols.; Berlin, 1884–1912.

Joannis Stobaei Eclogarum Physicarum et Ethicarum Libri Duo, ed. August Meineke, 2 Vols.; Leipzig, Vol. 1, 1860, Vol. 2, 1864 (BT).

Eclogae Physicae et Ethicae, ed. Thomas Gaisford; Oxford, 1850.

STRABO

Geographica, ed. C. Mueller and F. Duebner; Paris, 1853.

SYRIANUS

Syriani. In METAPHYSICA *Commentaria*, ed. Wilhelm Kroll; Berlin, 1902 (Commentaria In Aristotelem Graeca, VI^1).

TERTULLIAN

Quinti Septimi Florentis Tertulliani De Anima, ed. J. H. Waszink; Amsterdam, 1947.

De Anima; Paris, 1879 (Patrologiae Latinae, ed. Migne, vol. 2).

Apologeticus adversus gentes; Paris, 1879 (Patrologiae Latinae, ed. Migne, vol. 1).

THEMISTIUS

Orationes XXXIII, ed. Dionysius Petavius; Paris, 1684.

In Aristotelis PHYSICA *Paraphrasis*, ed. Henricus Schenkl; Berlin, 1900 (Commentaria In Aristotelem Graeca, V^2).

In Libros Aristotelis DE CAELO *Paraphrasis, Hebraice et Latinae*, ed. Samuel Landauer; Berlin, 1902 (Commentaria In Aristotelem Graeca V^4).

In Libros Aristotelis DE ANIMA *Paraphrasis*, ed. Richard Heinze; Berlin, 1899 (Commentaria In Aristotelem Graeca, V^3).

THEODORETUS

Théodoret de Cyr: Thérapeutique des Maladies Helléniques, ed. and trans. P. Canivet; Paris, 1958.

Theodoreti Graecarum Affectionum Curatio, ed. J. Raeder; Leipzig, 1914 (BT).

Graecarum Affectionum Curatio; Paris, 1864 (Patrologiae Graecae, ed. Migne, vol. 83).

THEOPHRASTUS

Theophrastus: Enquiry Into Plants, ed. and trans. Sir Arthur Hort, 2 Vols.; New York, 1916 (LCL).

Theophrastus and the Greek Physiological Psychology before Aristotle, George Malcolm Stratton; New York, 1917.

Theophrasti Fragmentum De Sensibus: in *Doxographi Graeci,* ed. with introd. by H. Diels; Berlin, 1958 (photocopy of first edition 1879.

Theophrasti Eresii Opera Quae Supersunt Omnia, ed. and trans. F. Wimmer; Paris, 1866.

VALERIUS MAXIMUS

Valerii Maximi Factorum et Dictorum Memorabilium Libri Novem, ed. Carolus Kempf; Leipzig, 1888 (BT).

Factorum et Dictorum Memorabilium, Libri Novem, ed. Carl Halm; Leipzig, 1865 (BT).

VARRO

M. Terenti Varronis Rerum Rusticarum Libri Tres, ed. G. Goetz (after H. Keil); Leipzig, 1912 (BT).

VITRUVIUS

De Architectura, ed. Silvio Ferro; Rome, 1960.

Vitruvius: On Architecture, ed. and trans. Frank Granger, 2 Vols.; New York, 1934 (LCL).

Vitruvii. De Architectura Libri Decem, ed. F. Krohn; Leipzig, 1912 (BT).

XENOPHON

Xenophon: Opera Omnia, ed. E. C. Marchant, 5 Vols.; Oxford, 1900–1920 (OCT).

Bibliography of the Modern Literature

(1) Alexi. *Anaxagoras und seine Philosophie nach den Fragmenten bei Simplic. ad Aristot.* ("Programm des Friedrich-Wilhelms-Gymnasiums" 12. April 1867.) Neu-Ruppin, 1867.

(2) Arleth, E. "Die Lehre des Anaxagoras vom Geist und der Seele," *Archiv fuer Geschichte der Philosophie*, 8 (N. F. 1) (1895), 59.

(3) Bailey, C. *The Greek Atomists and Epicurus.* Oxford, 1928.

(4) Bailey, C. (ed. with translation and commentary). *Lucretius: De Rerum Natura.* (3 Vols.). Oxford, 1950. (Reprinted from corrected first edition.)

(5) Bakewell, C. M. *Source Book in Ancient Philosophy.* New York, 1907.

(6) Bayle, P. "Anaxagoras," *Dictionnaire Historique et Critique de Pierre Bayle* (New Ed.), Vol. 2. Paris, 1820.

(7) Beare, J. I. *Greek Theories of Elementary Cognition.* Oxford, 1906.

(8) Beckel, H. *Anaxagorae Doctrina De Rebus Animatis.* Dissertation, Muenster, 1868.

(9) Bignone, E. "La teoria del peso in Empedocle ed Anassagora," *Bollettino di Filologia Classica*, 24 (1917–1918), 97.

(10) Bloch, K. "Anaxagoras und die Atomistik," *Classica et Mediaevalia*, 20 (1959), 1.

(11) Boussoulas, N. "Essai sur la structure du Mélange dans la pensée présocratique: Le *nous* et le Mélange dans le système d'Anaxagore," *Bulletin de L'Association Guillaume Budé* (Ser. 4), 3 (1956), 18.

(12) Brandis, C. A. *Handbuch der Geschichte der Griechisch-Roemischen Philosophie.* Berlin, 1835.

(13) Breier, F. *Die Philosophie des Anaxagoras von Klazomenae nach Aristoteles.* Berlin, 1840.

(14) Broecker, W. "Die Lehre des Anaxagoras," *Kant Studien*, 42 (1942/43), 176.

(15) Burnet, J. *Early Greek Philosophy.* London, 1892^1.

(16) Calvetti, C. "La Metafisica Di Anassagora," *Rivista Di Filosofia Neo-Scolastica*, 42 (1950), 422.

(17) Capelle, W. "Anaxagoras," *Neue Jahrbuecher fuer das Klassische Altertum*, 43 (1919), 81, 169.

(18) Capelle, W. *Geschichte der Philosophie I. Die Griechische Philosophie, Erster Teil: Von Thales bis Leukippos.* Berlin, 1953^2.

(19) Capelle, W. *Die Vorsokratiker: Die Fragmente und Quellenberichte, uebersetzt und eingeleitet.* Stuttgart, 1953^4.

(20) Carus, F. A. *De Anaxagoreae Cosmo-Theologiae fontibus Commentatio.* 1797. In *Nachgelassene Werke,* Vol. 4. Leipzig, 1809.

(21) Carus, F. A. "Anaxagoras aus Klazomenae und sein Zeitgeist: Eine geschichtliche Zusammenstellung," *Ideen zur Geschichte der Philosophie, Zweite Abtheilung.* In *Nachgelassene Werke,* Vol. 4. Leipzig, 1809.

(22) Carus, F. A. *Geschichte der Menschenkunde ueberhaupt der Seelenlehre insbesondere (Geschichte der Psychologie).* In *Nachgelassene Werke,* Vol. 3. Leipzig, 1808.

(23) Cherniss, H. *Aristotle's Criticism of Presocratic Philosophy.* Baltimore, 1935.

(24) Ciurnelli, D. *La Filosofia di Anassagora* ("Problemi D'Oggi: Collana di Filosofia e Storia della Filosofia,") Ser. 3, Vol. 4. Padua, 1947.

(25) Clemens, F. J. *De Philosophia Anaxagorae Clazomenii.* Berlin, 1839.

(26) Cleve, F. M. *The Philosophy of Anaxagoras.* New York, 1949.

(27) Cornford, F. M. *From Religion to Philosophy.* London, 1912.

(28) Cornford, F. M. "Anaxagoras' Theory of Matter," I and II, *The Classical Quarterly,* 24 (1930), 14, 83.

(29) Covotti, A. "Il 'Fisicissimo' del V.° Secolo avanti Cristo: Anassagora di Clazomene," *Atti Della Reale Accademia di Scienze Morali e Politiche,* 43 (1915), 211.

(30) Cudworth, R. *The True Intellectual System of the Universe: Wherein All the Reason and Philosophy of Atheism is Confuted and its Impossibility Demonstrated* (written 1678). New ed. with references, etc. by T. Birch. London, 1820.

(31) Davison, J. A. "Protagoras, Democritus, and Anaxagoras," *The Classical Quarterly,* 47 (1953), 33.

(32) Decharme, P. "Euripide et Anaxagore," *Revue des Etudes Grecques,* (1889), 234.

(33) Deichgraeber, K. "Hymnische Elemente in der Philosophischen Prosa der Vorsokratiker," *Philologus,* 88 (N. F. 42) (1933), 347.

(34) Dentler, E. *Die Grundprincipien der Philosophie des Anaxagoras.* Inaugural Dissertation. Fulda, 1897.

(35) Derenne, E. "Les Procès D'Impiété Intentés aux Philosophes à Athènes au V$^{\text{me}}$ et au IV$^{\text{me}}$ Siècle Avant J.–C.," *Bibliothèque De La Faculté De Philosophie et Lettres De l'Université de Liège,* 45 (1930).

(36) Diano, C. "La Data Di Publicazione Della Syngraphè Di Anassagora," *Anthemon: Scritti Di Archeologia e di Antichità Classiche in onore di Carlo Anti,* 235. Florence, 1955.

(37) Diels, H., and Kranz, W. *Die Fragmente der Vorsokratiker.* Berlin, 1960^9.

(38) Diller, M. "'Anaxagoras' Fragment 20," appendix to "Die Ueberlieferung der Hippokratischen Schrift, etc.," *Philologus, Supplementband* 23 (1931), 186.

(39) Dilthey, W. *Gesammelte Schriften, I. Band. Einleitung in die Geisteswissenschaften.* Stuttgart, 1959^4.

(40) Emminger, A. *Die vorsokratischen Philosophen nach den Berichten des Aristoteles.* Wuerzburg, 1878.

(41) Enriques, F., and Santillana, G. de. *Les Derniers "Physiologues" de la Grèce.* ("Histoire de la Pensée Scientifique" III.) Paris, 1936.

(42) Farrington, B. *Greek Science.* London, 1953^2.

(43) Fimiani, S. "Alcune osservazioni su la relazione tra il *nous* e la *psychē* nella dottrina filosofica di Anassagora," *Rivista Italiana di Filosofia,* 4^1 (1889), 66.

(44) Fraenkel, H. Review of J. Zafiropulo's *Anaxagore de Clazomène,* F. M. Cleve's *The Philosophy of Anaxagoras,* and D. Ciurnelli's *La Filosofia di Anassagora,* in *Classical Philology,* 45 (1950), 187.

(45) Fraenkel, M. *Wege und Formen Fruehgriechischen Denkens.* Munich, 1955.

(46) Freeman, K. *The Pre-Socratic Philosophers.* Oxford, 1953^3.

(47) Freeman, K. *Ancilla to the Pre-Socratic Philosophers.* Cambridge, Mass., 1957.

(48) Galli, G. "Anassagora," *Sophia,* 16 (1948), 187–189, 313–318.

(49) Gigon, O. "Zu Anaxagoras," *Philologus,* 91 (N. F. 45) (1936), 1.

(50) Giussani, C. (ed. with commentary). *T. Lucretius Carus: De Rerum Natura* ("Studi Lucreziani" Vols. I and II.) Turin, 1896.

(51) Gladisch, A. *Anaxagoras und Die Israeliten.* Leipzig, 1864.

(52) Gomperz, I. *Greek Thinkers.* Vol. I. Translated by Laurie Magnus. London, 1901.

(53) Heath, T. *Aristarchus of Samos: the Ancient Copernicus. A History of Greek Astronomy to Aristarchus together with Aristarchus's Treatise on the Sizes and Distances of the Sun and Moon.* Oxford, 1913.

(54) Heidel, W. A. "*Peri Physeōs*: A Study of the Conception of Nature among the Pre-Socratics," *Proceedings of the American Academy of Arts and Sciences,* 45 (1910), 79.

(55) Heidel, W. A. "Antecedents of Greek Corpuscular Theories," *Harvard Studies in Classical Philology,* 22 (1911), 111.

(56) Heinius, M. "La Vie D'Anaxagore, Philosophe très célèbre dans l'école Ionique," *Histoire De L'Académie Royale Des Sciences et Belles Lettres (Berlin),* 8 (1752), 313.

(57) Heinius, M. "Des Ecrits et De La Doctrine D'Anaxagore," *Histoire De l'Académie Royale Des Sciences et Belles Lettres (Berlin)*, 9 (1753), 355.

(58) Heinze, M. "Ueber den *Nous* des Anaxagoras," *Berichte ueber die Verhandlungen der koeniglich saechsischen Gesellschaft der Wissenschaften zu Leipzig*, (1890), 1.

(59) Hemsen, J. T. *Anaxagoras Clazomenius, sive De Vita Eius atque Philosophia Disquisitio Historico-philosophica.* Goettingen, 1821.

(60) Jaeger, W. *The Theology of the Early Greek Philosophers.* Oxford, 1947.

(61) Joehrens, O. *Die Fragmente des Anaxagoras.* Dissertation. Goettingen, 1939.

(62) Kirk, G. S., and Raven, J. E. *The Presocratic Philosophers.* Cambridge, 1957.

Kranz, W. See Kraus, M. J. (63); and Diels, H. (37).

(63) Kraus, H. J., Schmidt, H., and Kranz, W. "Ein Neues Hesiodfragment," *Rheinisches Museum fuer Philologie*, 95 (1952), 217.

(64) Krische, A. *Die theologischen Lehren der Griechischen Denker: Eine Pruefung der Darstellung Cicero's.* ("Forschungen auf dem Gebiete der alten Philosophie" Vol. I.) Goettingen, 1840.

(65) Kuiper, K. "De Mente Anaxagorea," *Mnemosyne* (N. S. 47) (1919), 124.

(66) Leon, P. "The *Homoiomeries* of Anaxagoras," *The Classical Quarterly*, 21 (1927), 133.

(67) Ludvíkovsky, J. "Studie o Anaxagorově theorii hmoty," *Listy Filologické*, 49 (1922), 65, 161.

(68) Luria, S. "Die Infinitesimal theorie der antiken Atomisten," *Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik; Abteilung B: Studien*, 2 (1933: Leningrad), 106.

(69) Mates, B. Review of F. M. Cleve's *The Philosophy of Anaxagoras*, in *The Classical Weekly*, 44 (1950), 41.

(70) Mathewson, R. "Aristotle and Anaxagoras: An Examination of F. M. Cornford's Interpretation," *The Classical Quarterly*, 52 (1958), 67.

(71) Meiners, C. *Geschichte des Ursprungs, Fortgangs und Verfalls der Wissenschaften in Griechenland und Rom.* Lemgo, 1781.

(72) Mieli, A. "Le teorie delle sostanze nei presokratici greci. Parte seconda: Anaxagora e gli atomisti," *Scientia*, 14 (1913), 329.

(73) Mieli, A. "La teoria di Anaxagora e la chimica moderna (Lo

sviluppo e l'utilizzazione di un antica teoria)," *Isis*, 1 (1913/1914), 370.

Mitchell, J. M. See Wallace, W. (106).

(74) Monrad, M. J. "Anaxagoras og Atomistiken," *Forhandlinger i Videnskab-Selskabet i Christiania*, (1870), 454.

(75) Mugler, C. "Le Problème D'Anaxagore," *Revue des Etudes Grecques*, 69 (1956), 314.

(76) Mullach, F. G. A. *Fragmenta Philosophorum Graecorum*. Paris, 1860.

(77) Nietzsche, F. *Die Philosophie im tragischen Zeitalter der Griechen*. 1873. In *Nietzsches Werke*, Vol. 10. Leipzig, 1896.

(78) Nolte, A. "Aristoteles et Theoria Noëtica Anaxagorae," *Mnemosyne*, (3rd ser.) 10 (1942/3), 204.

(79) Peck, A. L. "Anaxagoras and the Parts," *The Classical Quarterly*, 20 (1926), 57.

(80) Peck, A. L. "Anaxagoras: Predication as a Problem in Physics" I and II, *The Classical Quarterly*, 25 (1931), 27, 112.

(81) Peck, A. L. "Anaxagoras," *Encyclopaedia Britannica*, Vol. 2. Chicago, 1960.

Preller, L. See Ritter, H. (87).

(82) Raven, J. E. "The Basis of Anaxagoras' Cosmology," *The Classical Quarterly*, 48 (N. S. 4) (1954), 123.

Raven, J. E. See Kirk, G. S. (62).

(83) Reesema, W. S. van. *De Parmenidis, Anaxagorae, Protagorae Principiis et Platonis de Iis Judicio*. Leiden, 1840.

(84) Reesor, M. E. "The Meaning of Anaxagoras," *Classical Philology*, 55 (1960), 1.

(85) Rey, A. *La Science dans L'Antiquité: Vol. 3, La Maturité de La Pensée Scientifique en Grèce*. Paris, 1939.

(86) Ritter, H. *The History of Ancient Philosophy*. Translated by A. J. W. Morrison. Oxford, 1838.

(87) Ritter, H., and Preller, L. *Historia Philosophiae Graecae*, ed. E. Wellmann. Gotha, 1913^9.

(88) Rivaud, A. *Le Problème du Devenir (et la Notion de la Matière)*. Paris, 1906.

(89) Robin, L. *Greek Thought and the Origins of the Scientific Spirit in the History of Civilization*. Translated by M. R. Dobie. London and New York, 1928^2.

Santillana, G. de. See Enriques, F. (41).

(90) Sambursky, S. *The Physical World of the Greeks*. New York, 1956.

(91) Sarton, G. *Introduction to the History of Science*, Vol. I. Baltimore, 1927.

(92) Sarton, G. *A History of Science*, Vol. 1. Cambridge, Mass., 1959.

(93) Schaubach, E. *Anaxagorae Clazomenii Fragmenta Quae Supersunt Omnia; et de Vita et Philosophia Anaxagorae*. Leipzig, 1827.

(94) Schleiermacher, F. *Geschichte der alten Philosophie*. In *Geschichte der Philosophie*, ed. H. Ritter. In *F. Schleiermachers literarischen Nachlass "Zur Philosophie", Zweiten Bandes erste Abtheilung*. Berlin, 1839.

Schmidt, H. See Kraus, H. J. (63).

(95) Schorn, W. *Anaxagorae Clazomenii et Diogenis Apolloniatae Fragmenta Quae Supersunt Omnia*. Bonn, 1829.

(96) Schultz, W. "Der Text und die unmittelbare Umgebung von Fragment 20 des Anaxagoras," *Archiv fuer Geschichte der Philosophie*, 24 (*N. F.* 17) (1911), 323.

(97) Stace, W. T. *A Critical History of Greek Philosophy*. Reprinting of the first edition of 1920: London, 1953.

(98) Tannery, P. *La Science Hellène*. Paris, 1930².

(99) Taylor, A. E. "On the Date of the Trial of Anaxagoras," *The Classical Quarterly*, 11 (1917), 81.

(100) Tennemann, W. G. *Geschichte der Philosophie, Vol. I: Geschichte der Griechischen Philosophie bis auf Sokrates*, ed. with notes and additions by A. Wendt. Leipzig, 1829.

(101) Tiedemann, D. *Geist der spekulativen Philosophie von Thales bis Sokrates*. Marburg, 1791.

(102) Unger, G. F. "Die Zeitverhaeltnisse des Anaxagoras und Empedocles," *Philologus, Supplementband* 4 (1883), 513.

(103) Van der Waerden, B. L. *Science Awakening*. New York, 1961.

(104) Van Melsen, A. G. *From Atomos to Atom*. New York, 1960.²

(105) Vlastos, G. "The Physical Theory of Anaxagoras," *The Philosophical Review*, 59 (1950), 31.

(106) Wallace, W. and Mitchell, J. M. "Anaxagoras", *Encyclopaedia Britannica* (Eleventh Edition), New York, 1910.

(107) Wellmann, E. "Anaxagoras (4)," *Paulys Real-Encyclopaedie der Klassischen Altertumswissenschaft*, herausgegeben von Georg Wissowa. Vol. I. Stuttgart, 1894.

(108) Windelband, W. *History of Ancient Philosophy*. Translated by H. E. Cushman. New York, 1901.²

(109) Zafiropulo, J. *Anaxagore de Clazomène*. Paris, 1948.

(110) (Zedler). "Anaxagoras," *Grosses vollstaendiges Universal Lexicon Aller Wissenschaften und Kuenste, welche bisshero durch*

menschlichen Verstand und Witz erfunden und verbessert worden, Vol. 2. Halle, 1732.

(111) Zeller, E. *Die Philosophie der Griechen in ihrer Geschichtlichen Entwicklung. Erster Theil Zweiter Abschnitt*, Ch. III (*Anaxagoras*). Leipzig, 1876^4.

(112) Zevort, C. *Anaxagore: Dissertation sur la Vie et la Doctrine d'Anaxagore*. Paris, 1843.

(113) Zuccante, G. "Anassagora," *Reale Istituto Lombardo di Scienze e Lettere: Rendiconti*, 41 (Series 2) (1908), 617.

Footnotes to Part I

Chapter 1

1. Compare sources 1 (for Anaxagoras' fame); 61; 67; 132; 192; 205; 243; 261; 276; 340 (esp. the quote from Timon, and the epitaph at Lampsacus); 356; 369; 372; 401; 446; 466; 472; 561; 565; 600.

2. We are accepting the chronology given in source 340 by Diogenes Laertius, partially in the name of Apollodorus. Compare, however, the contradictory testimony on the date of Anaxagoras' death in source 386, the testimony in source 271 (which is wholly unreliable), and the mass of confused evidence concerning his place in time relative to other figures of the sixth and fifth centuries B.C.E. which appears throughout the sources. For detailed discussions of the problems arising in connection with Anaxagoras' dating see Heinius (56); Hemsen (59); Schaubach (93); Brandis (12); Zevort (112); Zeller (111); Unger (102); Burnet (15); Taylor (99); Ciurnelli (24); Davison (31); Kirk and Raven (62). We have little confidence in the chronology we have accepted, since its source cannot be called reliable according to the criteria set forth in Part III, Chapter 1; we have adopted it, in the absence of something better, since it appears to us to be a plausible account of the dates of Anaxagoras' life.

3. See sources 15; 16; 60; 85.

4. See sources 12; 85.

5. See source 191. Compared to much of the other evidence on Anaxagoras' life, the statement of Stesimbrotus (fl. late fifth century B.C.E.), if correctly brought by Plutarch, seems to be quite reliable because of the early date of its author.

6. We probably have the names of two of the more notorious ones in the quote from Aeschines of Sphettos (fourth century B.C.E.) in source 249.

7. See sources 7; 8; 13; 15; 16; and compare Part III, Chapter 2.

8. See source 1. In Socrates' time every literate person could be assumed to be acquainted with the contents of Anaxagoras' writings.

9. See source 3.

10. Euripides' plays contained doctrines of many of the natural philosophers, including at least something of Anaxagoras'. See Part III, Chapter 2 for a discussion of what we know about this, and see also Decharme (32).

11. See source 1.

12. See source 7.

13. See sources 11; 80.

14. See source 12.

15. See source 83.

16. See sources 81; 82.

17. See source 71.

18. See source 106, and Part III, Chapter 2.

19. See Part III, Chapter 2.

20. Compare source 205.

21. Compare source 356.

22. See source 84.

Chapter 2

1. See source 17 *passim.*

2. *Loc. cit.*

3. *Loc. cit.*

4. See sources 17; 34; 58.

5. See source 17, and source 73 for the closest thing we have to a direct quote of Anaxagoras' words concerning the size of the basic constituents of the universe.

That Anaxagoras' theory in some way involved quantities actually infinitesimal in size has been recognized most clearly by Zevort (112); Nietzsche (77); Giussani (50); Zuccanti (113); Capelle (18); Vlastos (105); Bloch (10).

6. That it was has always been acknowledged in the standard accounts (see Part III, Chapter 4, Section 1). However, that there were stable, elementary molecules in the theory has been recognized only by Cudworth (30); Ritter (86); Zevort (112); Nietzsche (77); Giussani (50).

7. See sources 17; 70.

Chapter 3

1. Compare source 43.

2. See sources 17; 21; 31; 34; 49; 60. Compare also Gomperz (52), and especially Peck (79), (80).

3. Compare sources 17; 49.

4. See sources 31; 60.

5. The main difficulty in determining which of these alternative views Anaxagoras held lies in the interpretation attached to the word *homoiomerē* in source 60. See especially Note 1 to that source, and Note 1 to source 17.

6. See source 17.

7. See source 49.

8. See sources 17; 68; 72; 74; 87; 89; 91; 92.

9. See source 72.

10. See sources 69; 72; 74.

11. See sources 17; 67.

Chapter 4

1. See source 61.

2. See sources 21; 25; 67; 75; 90. Compare also sources 3 and 27.

3. See sources 19; 32.

4. See sources 4; 21. See also *Webster's Dictionary of Synonyms*, Springfield (Mass.), 1951; p. 546: "*Mind* . . . denotes a complex of powers of which man is conscious and which includes the perceiving, the remembering, the thinking, and less often, the feeling and willing powers or functions. . . . the capacity for understanding and reasoning . . . the exercise of the powers that operate through physical organs (such as the eye, the ear, the brain, the nerves) . . ."

5. See Chapter 10, below.

6. See Chapter 9, below.

7. See *ibid.*

8. See Chapter 6, below.

9. See sources 4; 41.

10. See sources 41; 42.

11. See sources 41; 52; 53. Compare also Chapter 10, below.

12. See source 4.

13. See source 6.

14. See source 61, and Chapter 3, above.

15. See sources 19; 76; 77; 79. See also Zeller (111), especially p. 892, Note 2.

16. Sources 19; 65; 67; 79.

17. See especially source 67.

18. See source 3, beginning.

19. See sources 3; 20; 62; 277; 296; 302; 372; 408; 463; 466; 512; 514; 541; 542; 572; 612; 639; 640.

20. Compare for example sources 61; 108; 253; 299; 367; 372; 373; 561; 565; 600.

Chapter 5

1. See source 44.

2. See sources 87–89 and the Notes thereto.

3. Compare Arleth (2). Tiedemann (101) (p. 331) writes that Anaxagoras' theory of perception played a role in determining the nature of Mind in Anaxagoras' theory, but since the relevant sources were not known to him, he was unable to specify the role.

4. See sources 6; 26; 44; 45; 67. Compare also source 63.

5. Compare Cudworth (30); Bayle (6); Carus (22); Tennemann (100); Brandis (12); Breier (13); Gladisch (51); Zeller (111); Heinze

(58); Arleth (2); Zuccante (113); Capelle (18); Kuiper (65); Stace (97); Leon (66); Sarton (92); Joehrens (61); Bloch (10).

Chapter 6

1. See source 21.
2. See sources 21; 24; 25; 30; 67. Compare also sources 2; 11.
3. See source 22.
4. See sources 24, 25. See also source 413.
5. See source 29.
6. See sources 29; 3 (especially the end).
7. See source 9.
8. See source 21.
9. See below, next chapter.

Chapter 7

1. Compare source 29.
2. See sources 29; 39; 3.
3. See source 39 (especially the beginning).
4. See sources 23; 29; 57; 59.
5. Compare for example source 99.
6. See above Note 2 for the sources of this statement.
7. See sources 21; 23; 33; 46; 59.
8. See source 59.
9. See sources 38; 39; 40. Compare also source 91.
10. See Chapter 9, below.
11. See source 91, and compare source 33 and the Note thereto.
12. See sources 28 and 38.
13. See source 35, and compare source 31.
14. See below next chapter.
15. Compare Chapter 5, above.
16. See sources 92; 89; and compare sources 68; 72.
17. See source 56, and compare the not implausible reconstruction of this theory by Plutarch in source 158.

Chapter 8

1. Compare Dilthey (39) (p. 163 f.); Sambursky (90) (p. 24); and see also Gomperz (52).

2. Compare sources 1; 141; 166; 168; 196; 222–224; 482; 483; 597; 603.

3. See sources 1; 14.
4. See above, Chapter 6.
5. See sources 1; 5.
6. See source 5.
7. See source 37.
8. On Anaxagoras' belief in cosmic symmetry Gomperz (52) (p. 221) comments: "Anaxagoras was probably a little exorbitant in his demands on the symmetry of cosmic phenomena."
9. See source 36.

Chapter 9

1. See source 38.
2. See Chapter 7, above.
3. See source 40.
4. See sources 39; 40.
5. See source 39.
6. See Chapter 7, above.
7. See source 85.
8. See sources 85; 116; 117; 136; 179; 232; 248; 271; 596.

Chapter 10

1. See source 46.
2. See source 54.
3. See sources 52; 53.
4. See source 53.
5. See source 48.
6. See source 50.
7. See source 51.
8. See source 47.
9. See source 55. Compare also sources 86; 93.

Epilogue

1. Source 61.

Footnotes to Part II

(1)

1. The price of the most expensive seats in the theater at Athens at the time of Socrates' trial.

2. Literally, 'from the orchestra.' The orchestra in a Greek theater did not have seats in it, but was rather part of the area on which the actors played. From Aristophanes' *Clouds* we know that Socrates was represented on the stage in comedy spouting doctrines that were not necessarily his.

(3)

1. We have here accepted Wohlrab's emendation and the reading of MS. T in 97d2–3, as presented in Burnet's *apparatus criticus*.

(4)

1. From the noun *physis*, "the physical universe," and the verb *echō*, "to hold."

2. I.e. "life," the word used, for example, in the first line of this source.

(5)

1. *Selēnē* in Greek.

2. This is an explanation of the fact that at new moon the dark portion of the moon is seen to be faintly illuminated.

3. Contracted from *selas neon . . . henon aei*, literally 'brightness new and old always,' the words used in the previous line.

4. Hence the word for 'moon' reveals by its etymology that Anaxagoras' theory was known much earlier.

(6)

1. And these are properties which must belong to Right Rule.

(7)

1. Used as a derogatory term. This source is part of a bitterly sarcastic attack on rhetoricians in general, and on Pericles in particular.

2. We have chosen the reading of MSS. B and T. Socrates is again being ironic here: If one knows anything he must know its opposite too

(cf. source 3). Anaxagoras, then, who spoke of Mind or reason, certainly spoke as much of Mindlessness or foolishness!

3. Which is what true rhetoric should be, according to Socrates.

(17)

1. English lacks a term equivalent to the Greek word *homoiomerēs*. The latter is a generic term applied to all substances whose pieces have the same name and in general the same properties as the substance in mass; as a generic term it can refer both to such substances in mass, and to subdivisions of such substances having any size whatever—in particular, to molecules of such substances. Although English lacks such a term, all names of *particular substances* of this kind fulfill the same double function in English as *homoiomerēs* (and the specific names as well) in Greek. Thus, for example, 'water' refers in English both to a molecule of water, as in the sentence "Two atoms of hydrogen and one of oxygen combine to form water," where it is clear that a molecule of water and not a glass of water is meant; and to any quantity of water, as in the sentence "The most abundant liquid on the surface of the earth is water." In the same way, the word 'muscle' seen as a caption to a picture of a single cell of muscle tissue clearly refers to the smallest component of muscle tissue which still has the properties and name of muscle tissue; and the same caption could be applied to a picture of a large piece of tissue. In English, then, the double usage is common for all such particular names of substances, and is accepted as normal; the reader is expected to differentiate the meaning according to the context. Only the generic term for all such substances is lacking in English (except for the transliteration of the Greek generic term, 'homoeomery,' a word not found in common usage); and this lack may be supplied by combinations of the two terms 'molecule' and 'substance.' In English the two words are combined to form two different phrases according to the context: the phrase 'substances composed of molecules' refers generically to substances in mass, and the phrase 'molecules of (various) substances' (or 'molecular species') refers generically to the smallest sub-units of such substances. In translating Aristotle we have, accordingly, rendered the Greek *homoiomerēs* in one of these senses according to the requirements of the context.

Note that the meaning given for 'molecule' in the *Shorter Oxford English Dictionary* (Oxford; 1956^3) is: "*Physics* and *Chem.* One of the minute discrete particles of which material substances are conceived to exist. In modern chemistry the molecules of any element or compound are assumed to be of uniform size and mass, representing the smallest portions into which the substance can be divided without losing its chemical identity." For Anaxagoras the molecules were infinitesimal in size.

2. I.e. absolute qualities which lie at the extremes of the range of the various perceptible qualities; e.g. in the case of temperature, absolute hotness and absolute coldness.

3. And hence does not involve the creation or destruction of anything substantial.

4. I.e. almost everybody agreed that if one thing arises out of another, it existed in it previously in one way or another, imperceptibly. The followers of Anaxagoras are distinguished from the others by the fact that they believed that *all* things are in everything.

5. I.e. a continuous variation of quality in an infinite number of infinitesimal steps.

6. Viz. anything else similar to flesh and bone, the kinds of substance Anaxagoras called the elementary constituents of all things in the universe.

7. This has just been demonstrated in the preceding paragraph. Aristotle's argument is built sequentially, each part assuming as true the conclusions reached earlier.

8. I.e. if Anaxagoras' theory were carried to its logical conclusion. For if all things are really in all things then, since a molecule is also strictly speaking a 'thing,' it should also have all 'things' in it, though Anaxagoras, of course, exempted the elementary constituents from the rule—since they were elementary. Indeed, it is clear from *this passage* that Anaxagoras did not draw this conclusion, and that his infinitesimal constituents were in fact elementary and hence excluded from the class of things that contained all things; for Aristotle presents his result as one which would follow if one adhered to a strict interpretation of the formula "all things in all things"—as Anaxagoras did not.

9. Aristotle's argument is the following: When Anaxagoras said that no separation can be complete, he was simply saying that all things must remain mixture and that nothing can ever become pure, because things are mixed together in infinitesimal pieces. (Thus nothing can be separated "quantitatively," as Aristotle points out in what follows.) But Anaxagoras was also unwittingly stating the profound truth that attributes cannot be separated from objects. For in his theory the molecules possessed qualities which permanently attached to them, and which in fact could never be separated from the substances of which the molecules were made. Even though Anaxagoras certainly was not referring to this when he said that separation could never be complete, even though Anaxagoras of course never even considered the possibility that attributes might be separated from the molecules, still, since Anaxagoras' theory involved attributes permanently attached to molecules, attributes and molecules were in fact for him irrevocably inseparable, so that no process of separation in his theory could possible have sundered them. Thus, without thinking about it explicitly, Anaxagoras had built into his theory factors which could not be separated under any circumstances, so that no process of separation—no matter how thoroughly it succeeded in separating different substances from one another—could ever really be complete for him, since one would always be left with qualities attached to the particles.

Aristotle's praise of Anaxagoras here is part of his running polemic against Plato, who did separate qualities from matter. If Anaxagoras had separated the two, Aristotle would not have been able to praise him; on the contrary, Aristotle would simply have said "Anaxagoras errs basically in assuming that qualities can exist separate from matter." The unwitting correctness of Anaxagoras' statement that no separation is complete resides then in that aspect of the theory where attributes are irrevocably attached to matter—as Aristotle makes clear.

10. There were two basic concepts in Anaxagoras' theory of matter: molecules and qualities permanently attached to them. Correspondingly, according to Aristotle, there could conceivably be two kinds of 'separation': quantitative separation, i.e. separation of the infinitesimal molecules of one substance, such as flesh, from all the others, or separation of all the molecules having a given property, such as whiteness, from all the others; and qualitative separation, i.e. separation of qualities from the substance to which they are attached, such as the separation of the predicate 'white' from an infinitesimal molecule of white flesh. Neither type of separation could occur in Anaxagoras' theory. We have here again ridicule of Anaxagoras' theory for failing to carry through to a logical conclusion (see Note 8 above). Mind is supposed to separate things, but in fact in the theory separation is never fully carried out.

11. It is worth noting that this attack on Anaxagoras uses against him his own premises, or premises he would surely grant. This is not an attack from Aristotle's point of view, i.e. *not* an attack of the form "you hold this to be true, but I say, on the basis of my grasp of reality—which is the correct one and differs from yours—that your theory is false." On the contrary, this attack presupposes commonly agreed premises throughout, in a way which makes the attack effective against Anaxagoras and is calculated to force him to yield on the basis of the internal failings of his own theory.

This can be seen throughout. The arguments are: (1) Anaxagoras would surely grant that infinite quantities cannot be grasped by the mind, yet he says we can understand physical processes and Mind knows all. (2) Anaxagoras would surely grant that living organisms cannot be of arbitrary size, yet he says that tissues of arbitrary size can exist. (3) Anaxagoras would surely grant that a finite volume can only contain a finite number of finite-sized objects, yet his dictum that all is in all, taken together with the conclusion of (2) that the smallest particles must be finite, contradict this. (4) Anaxagoras speaks loosely of all things in *all* things, yet this leads directly to the conclusion that all things are in the infinitesimal molecules, which Anaxagoras certainly did not grant. (5) Anaxagoras speaks of Mind separating, yet this most perfect of all things in the theory is grossly imperfect in performing its task, since in the theory it cannot achieve separation.

Nowhere has Aristotle argued from his own point of view, which differs from Anaxagoras' in many basic respects. He has chosen instead, as he does frequently, to overthrow a system with which he is in disagreement by pointing to internal inconsistencies, and to lack of precision within the system itself. Cf. Daniel E. Gershenson and Daniel A. Greenberg, "Aristotle Confronts the Eleatics: Two Arguments on 'The One,'" *Phronesis*, Vol. 7 (1962), 137–151.

(21)

1. As opposed to the others who say that that which is infinite consists of one continuous body.

2. And before that time, in both cases, they were mixtures. This whole passage is based upon the comparison of each thing with the sum total of all things. In source 3 the same juxtaposition of 'each' and 'all' occurs.

(28)

1. Deriving *aithēr* from the words *aei thein*, 'to run always.'

2. Deriving *aithēr* from the word *aithein*, 'to burn.' Anaxagoras held that the uppermost regions were burning hot; see source 35.

(29)

1. Reading *athroon* in 294b20.

2. By constraint.

(30)

1. Rather than saying, as do the people under attack in this passage, that before the world was given its present form the matter in the universe was moving randomly.

(31)

1. This probably refers to the cosmogony, though we have no other more specific evidence on this point.

2. It is likely that this insertion explains that Aristotle has substituted the word 'heat' in the previous sentence for the word 'aether,' which must have occurred in the lost Anaxagorean context alluded to here. See Part III, Chapter 3, for a discussion *inter alia* of the passage which later antiquity took to be the lost context.

(32)

1. The attack is directed against all those physicists who propounded theories similar to that of Anaxagoras. Thus this source is useful only for

the general information it conveys, since the details attacked are collected from all the theories. For example, we can learn from this passage that substances which Aristotle considers to be compounds were taken by Anaxagoras in common with the other physicists of this group to be elementary; but we cannot learn which particular substances each of these physicists held to be basic. Compare Peck (80), p. 29 f.

2. Aristotle thought he had sufficient observational evidence to determine which substances are elementary and which are not. In fact, he did not have sufficient evidence. Compare Part I, Chapter 3.

3. Literally, in the Greek, "two or three," used loosely in the colloquial sense. Aristotle was quite aware that Empedocles' theory assumed the existence of four elementary kinds of matter!

(33)

1. See Bignone (9), who correctly takes this passage to mean only that Anaxagoras gave no rigorous explanation for variations in density.

(34)

1. Since he linked qualities to the molecules. Thus every time molecules are rearranged, change of quality must occur; so that in the theory dissociation and recombination actually constitute qualitative change. Aristotle disapproves of the confusion that is likely to ensue when no clear distinction is made between the language used to describe the rearrangement of matter and the language used to describe actual qualitative changes in a material substratum.

(35)

1. See source 28, and Note 2 thereto.

2. Although not right in the etymology he gave. The true etymology, which follows, justifies his choice of name.

3. See Note 1, source 28.

4. Greek *theion*, so that there is a pun here on the second syllable of *aithēr*.

(38)

1. The argument is somewhat abbreviated. Spelled out in detail it is the following: (1) The greater the cold, the greater the ice frozen. (2) The higher up one goes, the greater the cold. (3) Therefore, according to Anaxagoras' theory, the higher up hail is formed the greater would be the hailstones. (4) Thus in that theory the greatest hailstones would

be those formed at the highest altitudes. (5) But the asymmetry of large hailstones proves that they could not have formed at high altitudes, so that Anaxagoras' theory must be wrong. In the abbreviated form of the argument, steps (2), (3), and (4) were left out; they are, after all, elementary and obvious after the preceding discussion.

(41)

1. According to Democritus, we appear to be alive as long as we are conscious and have our wits about us; and this, for him, is really the criterion for the presence of life.

(43)

1. Those who use the other two criteria, namely, the presence of motion or of something incorporeal, certainly include either motion or the incorporeal substance as one of the basic elements of their theories. Aristotle is pointing out that even those who use the remaining criterion also say that life is one of the basic constituents of the universe, although they might be expected not to do so.

(49)

1. Viz. organic molecules, as the context—especially the comparison with the biologists—implies.

(52)

1. This work survives in a Latin version of an Arabic translation from the Greek.

(55)

1. Viz. because they need sunlight. We have followed Meyer's reconstruction (p. 58) of the Arabic translation.

(58)

1. The text of this work is filled with corruptions, and the title is not sure. The treatise abounds in logical contradictions, in misstatements of fact, and in absurd conclusions. It cannot be used as a reliable source.

(60)

1. Or alternatively "the great majority of molecular species." Because of the ambiguity of phrases such as this (see source 17, Note 1) we do not know whether inorganic molecules figured in Anaxagoras' theory.

(61)

1. A pun in the Greek, which also contains the meaning "was like a sober man among people who held that the universe lacked order."

(63)

1. Namely, with pure predicates.
2. Matter.

(67)

1. Though they obviously could not be in Anaxagoras' theory. Compare source 17, Note 9.

2. Gray is included in this list along with the primary colors black and white because pieces of mixed inorganic substances were also present in the original mixture in addition to the elementary molecules; compare the probable presence of colorless gas and aether in the mixture, source 31, Note 1.

(72)

1. Since for Anaxagoras the only real qualities are the pairs of contrasting qualities, and (as Aristotle goes on to show) these can never be truly predicated of any object simultaneously. Compare source 74.

2. Literally, "the things you talk about cannot be perfect or not perfect." Aristotle is taking the predicate "perfect" as an example of a well-defined property, since it is the best defined property and is itself a property of any well defined positive property.

(73)

1. I.e. to depart from his usual reference to pairs of opposing properties; alternatively, to depart from customary usage, which opposes 'many' to 'few.'

2. *Apeiros* here is clearly used loosely in the sense of excessive degree, since it is absurd to apply the strict meaning 'infinite in number' to fewness. Aristotle is whimsically interchanging the two meanings in order to find "an easy way out" for Anaxagoras, by which Anaxagoras could have avoided numerical infinities.

This attack on Anaxagoras' language is similar to the half-serious attacks elsewhere. Compare the attack on 'everything in everything' and on 'Mind separates things' in source 17; on 'all things mixed together' in source 67; on 'all things together' in source 75; and on the nature of physical change in source 34.

3. But rather, many and two, as Aristotle goes on to say. Compare source 17, where Anaxagoras is said to speak of many objects as well as of a single mass, and source 67, where Mind is added to the single mass to give the two basic elements in Anaxagoras' theory. The slight playful emendation of Anaxagoras' words thus at one stroke makes explicit what is implicit in source 67 and removes the problems arising from infinities (compare source 17).

This is a fine example of Aristotle's humor. Obviously this 'suggestion' would hardly help in view of the remainder of Anaxagoras' book, which spelled out the theory in detail!

See Alexander *ad loc.* in source 312.

(76)

1. Mind never changes; it is never potentially anything else, but always is what it is.

(77)

1. Since perfection is associated with the final state towards which things tend.

(85)

1. The part of this work that survives is extant only in a Latin version.

(86)

1. See Part III, Chapter 2, section 41.

(89)

1. Literally, 'powerful.' It is clear from this passage and from *De Sensu* 37 ahead (cf. Beare (7) p. 39, Note 1) that for Anaxagoras the stronger colors were the brighter ones, the weaker colors, the darker ones—as corresponds in fact to everyday experience, since brighter colors are more intense and more obviously colorful than the darker ones which tend to blend into each other and lose their distinctiveness.

2. Than in a light mirror; or perhaps, than a dark color in a light mirror. The sense of this passage is ambiguous.

3. Viz. by the interaction of bodies possessing different properties.

4. It is not possible to tell whether this or any of the other examples in this source come from Anaxagoras or from Theophrastus.

5. The meaning of this sentence is "elucidated" in the sentences which follow. See the next Note.

6. Theophrastus is evidently confused here. He makes the following statements in Anaxagoras' name: (1) Large animals have greater perception than small animals. (2) Rarefied air smells more strongly than dense air. (3) Large animals draw in dense as well as rare air. (4) Smells are denser when they originate close by than when they come from far away. (5) (introduced as a general conclusion from Anaxagoras' words) Large animals do not perceive rare smells nor small animals dense ones.

Now (1) and (5) are clearly contradictory, as are (3) and (5). (1), (2), and (3), on the other hand, are compatible and lead directly to the conclusion that large animals perceive weak and strong smells—in agreement with the general conclusion that large animals have greater perception. (4) introduces a new factor, the rarity or density of the *smell* as opposed to that of the smell-bearing air; (5) seems to be connected to (4) somehow, but certainly does not follow from (4) and in fact seems to appear from nowhere to ruin the argument.

The solution to the problem will be found ahead in the source: Theophrastus has confused Anaxagoras' theory with that of Empedocles—probably because, as we are told above, Anaxagoras did not supply too many details in his discussion of smell; the result of this confusion is discussed in Note 7.

7. The solution to the contradiction raised in Note 6 above is given in this passage. Theophrastus assumes that the basis of Anaxagoras' theory is the same as that of Empedocles', an assumption clearly unwarranted by Anaxagoras' writing since Theophrastus brings no support for his conjecture. In fact, this conjecture is the source of the inconsistencies in this source.

Anaxagoras clearly said that the capacity to perceive depends on the total intake of stimuli, which in turn depends directly on the size of the sense organ. A large animal can inhale more air than a small one, so that a large animal inhales dense *and* rare air (not dense *rather than* rare air, as Theophrastus would have it!) while a small one inhales only rare air. Large animals can thus perceive strong smells (associated with rare air) and weak smells (both those consisting of dense air as well as weaker smells arriving from great distances which can be perceived only if large quantities of the smell-bearing air are inhaled), while small animals can perceive only strong smells (associated with rare air) so that large animals have more perception than small ones.

Anaxagoras' theory is thus entirely self-consistent. The contradictions arise only when Empedocles' assumptions are introduced arbitrarily.

8. What Theophrastus has not taken into account in this critique is the psychological factor involved in sight, by which the physical impressions received on the pupil are converted into objects of consciousness.

9. Sic!

10. See Note 8 above.

11. Viz. daylight, to illuminate objects and make them contrast with the color of the eyes.

12. And therefore being equally illuminated, should be seen less distinctly than white objects, which they are not. However, the meaning of this sentence is not entirely clear; see Beare (7) p. 39, Note 2.

(91)

1. See source 33 and Note 1 there.

(93)

1. See Part III, Chapter 2, Section 3(l).

(96)

1. This must refer to some mention by Euripides of a cosmological theory, but no such mention appears in the papyrus fragment.

(97)

1. From this source on we have translated the Greek words *homoiomereia* and *homoiomerēs* with the English word 'homoeomery' since the meaning attached to the terms by writers after Aristotle varies considerably, and we have preferred to allow each author to explain the word himself because of the great variety of meanings given to it in our sources. Compare Kirk and Raven (62), p. 388, who write that for later authors the word *homoiomereia* became "a catchword that was almost automatically applied to Anaxagoras' physical theories; and it seems very probable that many of those who used it did so without understanding its exact significance." Compare also the excellent discussion given by Dentler (34), p. 18 ff.

In our passage here Lucretius simply transliterates the word *homoeomeria* from the Greek. The singular form in the phrase 'the homoeomery of Anaxagoras' is analogous to the singular form in the phrase 'the atom of Niels Bohr.' The former phrase refers to the particular conception Anaxagoras had of the nature of homoeomeries, which were assigned different properties in other theories as well.

2. Literally, "anything nourished by human flesh," e.g. the ashes of cremation or the dust of decay.

3. Because ewes eat grass and drink water, and presumably make milk out of these.

4. We have taken this entire passage to read consecutively as in the MSS., not finding it necessary to assume the existence of a lacuna either after line 860 or after line 873.

The correct interpretation of this passage, which we have attempted to bring out in our translation, can be found in Mathewson (70) p. 80, Note 2.

Lucretius errs in his account of Anaxagoras' theory in that he takes as the basis of the theory the principle that all substances are made up of pieces identical in nature to the whole, and of such pieces only. He proceeds to attack this mistaken construction, and then presents Anaxagoras' true theory as a defense Anaxagoras might make to the attack. From Lucretius' text, then, Anaxagoras' true theory appears not to be Anaxagoras' at all, but an ingenious invention of Lucretius on Anaxagoras' behalf.

(99)

1. That is, to make long speeches in court. In public trials the water-clock was used to time speeches. Perhaps Cicero is playing on Anaxagoras' well-known connection with the water clock.

(106)

1. This passage can not be located in any extant play of Euripides.

(108)

1. Compare Aristotle *Physica* 242b25.

2. Since the mind of any individual living being is part of the cosmic Mind, any stimulus perceived by any living being would be perceived by Mind as a whole, with the result that in Anaxagoras' theory Nature as a whole would have to perceive any stimulus. Compare source 43.

3. Sc. a mind of its own, since every living being possesses a mind.

4. Which would also allow Mind to be a living being; since Mind could be a living being if it had an external body, not only if it had another mind within it. For Cicero, both alternatives are unacceptable.

5. I.e. with no material organ through which it can perceive.

(109)

1. See source 86.

(110)

1. The translations from this work depend on Sudhaus' reconstructions.

(111)

1. Due to the state of the papyrus, the name which belongs here is gone.

2. This appears in a list of philosophers who were indicted on various charges. Anaxagoras is followed in the list by Pythagoras and Socrates.

(112)

1. The speaker referred to is not known.

(114)

1. We do not know who this person was.

2. This man cannot be identified with any certainty. However, if, as seems likely, the passage deals with Epicurus, he may be Nausiphanes (late fourth century B.C.E.), a teacher of Epicurus who lived on Teos. See Sbordone, p. 128 f.

(115)

1. Here the accounts of all the natural philosophers who posited that the world was created are conflated. It is clear that the account as a whole should not be taken to belong to any particular one of them, nor do we have sufficient information to enable us to identify its various sources.

At the end of our passage Diodorus points out that even an artist, the tragedian Euripides, agreed with this general account. (It is likely that Euripides is the source of this account, perhaps in the lost play *Melanippe*; see the end of this source, and sources 119, 120.) To explain this agreement, he remarks that Euripides was a student of one of the scientists who held the view that the world was created, namely, Anaxagoras. Later tradition fastened on the name of Anaxagoras and attributed to him the entire account. See Part III, Chapter 2.

2. *Sc.* air.

3. A lost play of Euripides.

4. For the first part of the sentence whose end is quoted here see source 120.

(119)

1. A lost play of Euripides. See source 120, which is very similar to this one.

(120)

1. Compare the end of source 115 and source 119.

(123)

1. Literally, "a correspondence to lines," i.e. a correspondence to the boundaries which delineate objects and define their shape.

(124)

1. It should be noted that Vitruvius is careful to ascribe these views to Euripides and not to his teacher Anaxagoras.

(128)

1. *Sc*. a homogeneous mass of matter, the mixture.

(131)

1. Compare sources 81, 82.

(133)

1. Compare source 7.

(135)

1. Which is seen as lightning.

(139)

1. Which has not survived. Charmander is known to us only through Seneca.

(141)

1. 467/466 B.C.E.

(146)

1. Sic! This passage confuses Anaxagoras with Anaxarchus.

2. Compare the opening lines of source 3, from which this quote differs in some particulars.

3. Reading with Keil *syntithesthai* for *sōtisesthai*. The latter, which is found in the manuscripts, is nonsense, and Keil's reconstruction is plausible due to the orthographic similarity of the two words.

4. *Aeneid* 6.726 f.

5. *Nous*.

6. *Spiritus*.

(147)

1. There follows a transcription of all of source 14.

(150)

1. *Odyssey* 8.246.

2. From Plutarch's words it is impossible to determine whether the phrase "as Anaxagoras said" is meant to refer to the entire sentence or to the words "technical skill" alone. There are three reasons however to prefer the second alternative: (1) Anaxagoras is known to have differentiated man from animals by reason of his technical skill (see sources 48 and 154) rather than by his wisdom, etc. (2) The rest of the sentence fits into the first person plural structure Plutarch uses in the context of his quotation from Homer. (3) The use of *spheis* for the pronoun of the first person plural seems to be later than the time of Anaxagoras.

(153)

1. See source 5.

(157)

1. I.e. a way to find an exact value for *pi* geometrically.

(158)

1. The Greek has 'appears' here, plainly an impossible reading. Our translation gives the sense of the various emendations proposed for this crux on the basis of common sense, and on the basis of source 56.

2. From a lost lyric poem.

(161)

1. This work was a textbook appropriate for an elementary course in the history of science and philosophy. It is arranged according to subject rather than according to author.

2. The Greek word for 'things' in the preceding quotation. In the time of Plutarch this word meant 'money,' and so as explanation of its use by Anaxagoras was necessary, at least in an elementary textbook such as this.

(165)

1. I.e., "Why is the surface of the earth inclined to the plane of the ecliptic?" Or possibly this means, "Why is the celestial equator inclined to the plane of the ecliptic?"

(174)

1. This includes planets.

(183)

1. And do not come to be out of nothing. In this way the cosmological and biological theories of the Epicureans are linked.

2. This passage is not found in any of the extant plays. It is not clear whether it is to be taken, as Plutarch took it, to refer to living organisms, or, as is more likely, to objects in general (with a poetic use of the verb 'to die' in place of 'to be destroyed').

(186)

1. We have translated all that remains of the text here.

(193)

1. See source 7.

(196)

1. I.e. of the defeat of the Athenians at Aegospotami in 404 B.C.E.

2. Thus they could be expected to have fallen down to earth.

3. I.e. Anaxagoras' explanation, just presented, for the fall of the stone at Aegospotami.

4. Thus Anaxagoras' theory is in line with the theory that shooting stars are made of stone. Plutarch notes this agreement probably because according to him (see source 174) Anaxagoras did not subscribe to this theory of shooting stars but rather to the first one of those mentioned in this paragraph.

5. Of Anaxagoras. The more convincing explanation is the one given by those who say that shooting stars *are* the kind of phenomena denied in the previous sentence. Aristotle belongs in this group, and indeed he explicitly states the "more convincing theory," that the stone was a rock buffeted by the wind, in *Meteor.* 344b30 ff.

6. There is a gap in the text here, and the more convincing theory is never stated. However, we know from the end of this source that the theory referred to must have been that the stone which fell at Aegospotami had been carried there from a high mountain by a cyclone. The passage dropped out in the course of copying probably because the terminology used to describe the whirling of the cyclone (see ahead) was very similar to that used to describe the rotation of the heavenly bodies, just before the lacuna.

7. Which was, as we have just seen, that the stone fell from the heavens.

8. Thus Plutarch attempts to reconcile the observation recorded by Daimachus with Aristotle's explanation, which he prefers.

(198)

1. The number is illegible. From the surrounding entries it is clear that these men are to be dated in the fifth century B.C.E.

(199)

1. This and all other unidentified quotations in the commentators on Aristotle and Plato come from the passage which begins with the line cited in parentheses in the heading of the source.

2. See source 89.

(201)

1. This work is preserved only in fragmentary form on a palimpsest. The passage containing the name of Anaxagoras is not connected to anything else in the book.

(205)

1. There is a lacuna in the text at this point.

(206)

1. Compare sources 81, 82.

(208)

1. See source 7.

(209)

1. Sic!

(216)

1. This book, like Plutarch's *Handbook* (see source 161, Note 1), is a textbook in the history of science and philosophy. It covers much the same subject matter as Plutarch's book, and often the wording is similar or even identical. Indeed it was not uncommon for a textbook writer in antiquity to copy entire sections of previous textbooks—since there was no prohibition

on such copying and no requirement to identify the source—as it has always been the practice of writers of commentaries and textbooks to take ideas and methods of presentation from their predecessors. Other such handbooks represented in these sources are those of Eusebius, Theodoretus, and Stobaeus.

(217)

1. Compare source 161.

(218)

1. Compare source 163.

(219)

1. Compare source 162.

(220)

1. Compare source 164.

(221)

1. Compare source 165 and the Note there.

(222)

1. Compare source 166.

(223)

1. Compare source 167.

(224)

1. Compare source 168.

(225)

1. Compare source 169.

(226)

1. There is a lacuna in the text here which makes this source incomprehensible as it stands. The translation is an attempt to make sense of what remains.

2. Compare source 170.

(227)

1. Compare source 171.

(228)

1. Compare source 172.

(229)

1. The meaning of this passage is less than clear. Compare source 173.

(230)

1. Compare source 174.

(231)

1. Sic!
2. Compare source 175.

(232)

1. Compare source 179.

(233)

1. There is a lacuna in the text at this point.
2. Compare source 183 and the Notes there.

(234)

1. Compare source 185.

(236)

1. This work is extant only in an Arabic translation of the original Greek. We have made our translation from the German translation cited in the Bibliography.

(247)

1. This statement is the first in a list of brief remarks all dealing with eggs and all taken out of context. The list appears in the epitome of the second book of Athenaeus. Desrousseaux and Astruc, p. 141, Note 7, explain Anaxagoras' statement as a serious biological exposition of a popular saying. To us the meaning of the passage remains obscure.

(248)

1. This section, on the rising of the Nile, is found in several, but not all of the manuscripts of the epitome of Athenaeus, Book II.
2. This is correct; compare source 85 and Part III, Chapter 2.

3. A lost drama of Euripides.

4. There follow the first three lines of Euripides' *Helen.*

(252)

1. This is probably what the phrase *dia graphēs ekdounai biblion* means. Compare source 340. On the basis of these passages Heinius (57) (p. 356) says that Anaxagoras was the first to publish an extended account of his theory, and not only aphorisms; Gomperz (8) (p. 209, and p. 556, Note to p. 208) calls Anaxagoras' book the first book "illustrated with diagrams which Greek literature possessed"; Robin (89) talks of several volumes "illustrated with figures—for example, to describe the phases of the moon"; Diano (36) maintains that Anaxagoras' book was neither illustrated nor the first manuscript to have been published at Athens, but rather the first prose writing to be published as a book.

(255)

1. See source 41. Compare also source 42.

(257)

1. Is this our Anaxagoras?

(262)

1. Conybeare, Vol. I, p. 577: "Anaxagoras wears a fleece, probably as a rain-making ceremony." (Sic!)

(265)

1. Sic! Thales as well as Anaxagoras was tried, according to Philostratus!

(267)

1. The person referred to is Euripides, whom Clement mentioned by name a few lines above. See Vitruvius, source 124.

(270)

1. The following three sources are taken from a work ascribed in the MSS. to Origen, but frequently cited as the work of Hippolytus (late second century C.E.—early third century C.E.) since the middle of the nineteenth century.

(271)

1. Sic! For Anaxagoras matter never undergoes physical change, though its rearrangement constitutes observed physical changes.

2. See Part III, Chapter 3.

3. It is not clear how the author connected the absence of a void with the fact that the earth stays up in its place. This is the only source which connects the void with the theory that the earth floats on air. Perhaps some connection was assumed by the author because of Anaxagoras' experiments which disproved the void and at the same time proved that gas can resist pressure. Cf. sources 23, 57, and especially 29.

4. Viz. salty.

5. This is either an additional reason for the saltiness of the sea (compare source 291), or a reason why the sea does not disappear as a result of evaporation.

6. Compare source 39. The water which clogs the pores of the earth has become here water which fills the hollows of the earth.

7. Compare source 85. This is the only source which identifies Anaxagoras with the opinion that the snow is located in the north.

8. This statement is found attributed to Anaxagoras in no other source. It is generally attributed to Anaximenes, who was widely held to be Anaxagoras' teacher (see, for example, source 108).

9. It is difficult to see how the stars, which are said above to have been snatched up by the flaming hot aether, can be in a cooler region than the sun.

10. Compare above where we are told that the moon is a red-hot stone, and below, where we are told it shines by reflected light and is made of earth.

11. It is not clear what this is supposed to mean.

12. Compare source 39.

13. The phrase usually refers to the fortieth year of life. The date given (compare source 39) corresponds to the traditional date for Anaxagoras' *death*.

14. 428/7 B.C.E.

15. Compare for example source 262.

(277)

1. We read *hydōr* with the MSS. here.

2. These two criticisms are dealt with in the following two paragraphs, in inverse order.

3. Since attributes are prior to the things they modify. Mind is here identified with existence. Compare source 76.

4. And that in turn infinite by virtue of an accidental relation to something else, and so forth *ad infinitum*, an obvious absurdity.

5. And hence, in effect, any body can be subdivided until nothing at all remains.

6. See above, the opening sentence of the source.

7. There are two arguments here: first, that life cannot be composed of atoms because it is so different from the atoms that make up matter in Anaxagoras' theory; and second, that life must have a material basis which must be continuous—since the nature of matter is to be continuous—and hence can not be atomic.

(280)

1. Compare source 19.

(282)

1. Compare the beginning of source 67.

(283)

1. Compare source 35.

(284)

1. See source 36.

(287)

1. Compare source 37.

(288)

1. Compare source 38.

(289)

1. See source 38.

(292)

1. See source 39.

(293)

1. See source 40.
2. See source 28. Compare also source 35.

(295)

1. See source 60.

2. See source 32.

3. See the end of source 67. Alexander's quotation from Aristotle here differs from the accepted text, and we have translated accordingly.

(299)

1. See source 61.

(301)

1. Compare source 61.

2. I.e., the factor which fashions all things, and the matter of which things are made.

3. See source 62.

4. See source 3.

(302)

1. Compare source 62.

(305)

1. See source 63.

2. But compare the end of source 77; and cf. source 299.

(306)

1. See source 64.

(307)

1. See source 65.

(308)

1. See source 65.

(309)

1. See source 66.

(310)

1. See source 67.

2. Compare source 295, which gives just the opposite interpretation of the phrase "after him in his philosophical activity." Here Alexander evidently takes this phrase to mean "more modern and up-to-date in philosophical activity than he."

(311)

1. See source 67.

(312)

1. Compare source 68.
2. See source 67.
3. See source 17.

(314)

1. See source 67.

(315)

1. Compare source 69.

(316)

1. See source 69.

(318)

1. Compare source 71.
2. That sense perception is the basis for each man's conception of truth. See Aristotle's *Metaphysica*, Book 3, Chapter 5.

(320)

1. Compare source 72.

(321)

1. See source 72.

(323)

1. That there is something intermediate between negation and affirmation.

(324)

1. See sources 71, 72.

(327)

1. See source 73.
2. See source 73, Note 3.

(328)

1. See source 74.

(329)

1. See source 75.

(330)

1. See source 75.

(331)

1. Compare source 76.

(332)

1. See source 76.

(333)

1. The word Alexander quotes from Anaxagoras here is the same one which appears in 1075a23–24 with the meaning "distinguished."

(334)

1. Compare source 77.
2. I.e. towards the perfection which is Mind.

(335)

1. See source 79.

(336)

1. We do not, in fact, know when Diogenes Laertius lived, and he may have flourished at any time between the early third and the early eighth century C.E. Although there is no real evidence which allows us to narrow this range, we have here accepted the dates which represent the consensus of scholarly opinion. His book is a helter-skelter collection of accounts from a great number of sources (most of them lost) which has little order, little coherence, and little claim to authority, except in so far as an identified source can be relied upon—if the identification is to be trusted!

(340)

1. 500/499–496/495 B.C.E.
2. 428/7 B.C.E.

3. Not extant.

4. Built over seventy years after Anaxagoras' death, according to Diogenes' own chronology (compare *Life of Eudemus*, 8.87).

5. No such Athenian archon is known from the archon-lists which have come down from antiquity.

(342)

1. Compare source 8. Socrates has been assigned the same teachers as Pericles.

(344)

1. Note that here Socrates' relation with Anaxagoras is stated as a fact; compare source 342 above.

(345)

1. See source 1, and compare source 3.

(346)

1. Not extant.

(350)

1. Compare source 5.

(356)

1. This entire diatribe contains many allusions to earlier sources, especially to those from Aristotle's works. See Part III, Chapter 3.

(357)

1. This source is not in contradiction to the previous one. Lactantius is here arguing from the desirability of life in this world to the desirability of immortal life in the world to come, and pointing out that if life in this world is precious on account of material objects in it, then immortal life in the world to come—where the soul is freed from all matter—must be many times more precious than life on earth.

(360)

1. See the preceding source.

(361)

1. This is addressed to one of the two opponents of Christianity, unknown by name, whom Lactantius met in Bithynia and to whom he addressed the *Institutiones Divinae*.

(365)

1. Or else Euripides or Menander. See Nauck Eur. 1007.

(368)

1. As Philo, whom Eusebius has just brought at length.

2. In the second book of *Contra Apionem*. See source 142, of which this is almost exactly a copy.

(370)

1. This is part of a quotation from a lost work by Atticus attacking those who claim they can learn Plato's doctrines from the works of Aristotle.

(372)

1. Source 3 is quoted in its entirety, except for the passage "for the inability to distinguish a real cause . . . calling such things explanations!", which is replaced by Eusebius' words "Then he adds."

(373)

1. A copy of source 162.

(376)

1. An almost exact copy of source 168.

(377)

1. A copy of source 169.

(378)

1. An almost exact copy of source 171.

(379)

1. An almost exact copy of source 166.

(380)

1. An almost exact copy of source 165.

(381)

1. A copy of source 167.

(382)

1. Much the same as source 172.

(383)

1. This source is almost the same, word for word, as source 178.

(385)

1. 500/499–496/495 B.C.E.

(386)

1. 460/459–456/455 B.C.E.
2. Sic! See source 385.

(390)

1. See source 97.

(399)

1. This reference is completely obscure.

(402)

1. Themistius pictures the city of Athens addressing Philosophy in the person of a number of her citizens.
2. Compare source 7.

(404)

1. See source 17.

(406)

1. Compare source 18.

(407)

1. See source 19.

(408)

1. See source 20.

(409)

1. See source 21.

(410)

1. See source 22.

(411)

1. See source 23.

(412)

1. See source 24.

(413)

1. See source 25.

(414)

1. See source 26.

(415)

1. The original Greek text of this work is lost; it survives only in a Hebrew translation, and in a Latin translation of a lost Hebrew version. Since the Hebrew translation is in turn a translation from the Arabic and so is very far from the original, we have not thought it worthwhile to translate those passages which are virtually identical to the passages in Aristotle of which they are paraphrases. We have only translated those sections which obviously add interpretation to material from Aristotle.

(418)

1. See source 30.

2. I.e. from a natural state of chaos to an unnatural state of order imposed upon the chaos by an external force.

(421)

1. Including Anaxagoras.

(424)

1. See source 41.

(425)

1. See source 41.

(426)

1. See source 42.

(427)

1. See source 43.

(429)

1. See source 44.

2. Although he was engaging in wild fantasy when he spoke of a time when there was no motion and change. See source 25.

3. It seems that according to Themistius, Anaxagoras believed that something can only be perceived by something else having the same properties. Thus Theophrastus' *On Sense Perception* (sources 87–92) must have been unknown to him. Compare Tiedemann (101).

(430)

1. See source 45.

2. Compare Nietzsche (77).

(433)

1. I.e. Pliny the Elder.

(435)

1. Athens.

(438)

1. Compare source 6.

2. Compare source 61.

3. See source 108 for this phrase. That source is Cicero's refutation of Anaxagoras referred to at the beginning of the next paragraph, and is the text for the rest of our passage.

4. Cf. source 100.

5. Cicero often expounded Stoic and Epicurean views, so that this too is part of Augustine's attack on him.

6. I.e. by putting the ending *-rion* of the word *centurion* on the stem *litera-* of *literatus*, a man of letters.

(439)

1. 500/499–496/495 B.C.E.

(441)

1. Compare source 69.

2. I.e. those who hold that contrasting predicates apply to one object at the same time.

(442)

1. See source 71.

(444)

1. See source 78.

(447)

1. *Iliad* 21.196.

(451)

1. Compare the similar passage in source 166.

(452)

1. An almost exact copy of source 168.

(453)

1. Compare source 169.

(454)

1. This is essentially a copy of source 171.

(456)

1. Compare source 180.
2. Compare source 183.

(458)

1. Compare the very similar wording in the first sentence of source 164.

(463)

1. See source 3.

(465)

1. See source 7.

(466)

1. See source 3.

(467)

1. See source 3.

(469)

1. See source 9.

(470)

1. Anthemius, to whom the poem is addressed.
2. Anaxagoras is the last in a list of philosophers.

(471)

1. I.e. in the line of Ionian philosophers.

(472)

1. See source 7.
2. Compare source 3.

(474)

1. In our translations from Stobaeus we have not accepted the readings restored from the late Codex L in Wacksmuth-Hense and in Diels. Stobaeus' anthology is a textbook in the same tradition as Plutarch, Galen, etc.

(475)

1. This source is the same as 164 except that the first four words are missing in the manuscripts of Stobaeus, being added in the margin (cf. Wacksmuth-Hense *app. crit. ad. loc.*); and the last sentence here is added.

(476)

1. Compare the similar passage in source 161.

2. Perhaps the lacuna in this sentence is to be restored along the lines of the parallel source 161, so that one should read, "Because the

particles in food are similar to the tissues which grow from them," in place of "that the particles in food belong to the tissues which grow from them."

(478)

1. This source is the same as 165.

(479)

1. Compare the similar passage at Plutarch *De Placitis* 1.24 where the names of Anaxagoras and Democritus are omitted.

(481)

1. Compare source 450.

(482)

1. The first part of this source is identical to source 166, with one very minor difference. For the second part compare the wording of source 167, which is identical to the wording here except for the omission of the names brought in Plutarch.

(483)

1. Compare sources 168 and 170, where the identical wording is to be found in the statement of Anaxagoras' doctrines.

(484)

1. Source 171 is almost identical to this.

(487)

1. Compare source 172.

(488)

1. Source 173 is identical to this one.

(489)

1. Compare source 174, which is identical except in minor details.

(490)

1. This passage is essentially identical to source 175.

(492)

1. Compare source 180.

(493)

1. Compare source 185.

(494)

1. As well as Democritus mentioned immediately above.

(496)

1. On the phrase "or even contrary in nature."

(497)

1. See source 17.

(498)

1. See source 17.

(499)

1. See source 17.

(500)

1. See source 17.

(501)

1. See source 17.

(502)

1. See source 17.
2. I.e. if they were to involve infinities.
3. There is a pun in the Greek here. Since pygmy means literally 'a person the size of a fist,' this can be read alternatively, "People the size of a fist can exist, but not a person the size of a finger or of a fig seed."
4. Rather than being fused into one.
5. Hence the homoeomeries can not be numbered, since they can always be subdivided into more than any given number.
6. Philoponus' text most likely had Ar. *Phys.* 188a9–13 before 188a5–9. It seems too that 188a11–13, the expansion upon 9–11, was missing in his text. Cf. Philoponus *In Phys.* 397.13–14.

(503)

1. See source 17.

(504)

1. See source 17.

(505)

1. See source 17.

2. I.e. the second in order from the beginning of the attack on Anaxagoras, but the first 'pertinent' one. Philoponus begins the third argument (the second 'pertinent' one) at 187b35, and the fourth at 188a2.

(506)

1. See source 17.

(507)

1. See source 17.

2. Here too we see clearly that 188a9 preceded 188a5 in Philoponus' text of Aristotle. See source 466, Note 6.

(508)

1. Compare source 17.

(509)

1. Compare source 17.

(510)

1. Compare source 17.

(511)

1. See source 502 above. The premises are that something comes to be either out of nothing, or out of something which already exists and is the same as the thing which comes to be from it, and in no third way. From this it can be deduced that change does not really exist.

(512)

1. See source 3.

(513)

1. See source 19.

(514)

1. See source 20.

(515)

1. See source 21.

(516)

1. See source 21.

(517)

1. See source 21.

(518)

1. See source 21.

2. The literal rendering of the words translated "from a mixture" in source 21. Philoponus takes them to mean "from a body such as it itself is."

3. A possible rendering of the words translated "except for the universal mixture from which all things came to be."

(522)

1. See source 22.

(523)

1. See source 22.

(524)

1. Brandis' edition of the scholia on Aristotle [C. A. Brandis, *Scholia in Aristotelem*, edidit Academia Regia Borussica; Berlin, 1836] refers to a book with the same title written against *Xenocrates*, in the scholion on 366b17.

(525)

1. Compare source 23.

(527)

1. See source 26.

2. And hence does not participate in processes of dissociation and recombination.

3. On the assumption that the organ of perception must be similar to the object perceived. But see source 558!

(529)

1. The Greek title of this book indicates that it consists of classroom notes taken by Philoponus at the lectures of Ammonius, the son of Hermias, with the addition of some of Philoponus' own remarks.

(530)

1. See source 34.

(531)

1. See source 34.

(532)

1. See source 34.

(533)

1. See source 34.

(536)

1. See source 34.

(538)

1. And not the elementary kinds of matter themselves.

(541)

1. See source 3.

(543)

1. See source 35.

(544)

1. See source 36.

(545)

1. See source 37.

(546)

1. See source 38.

(547)

1. See source 38.

(548)

1. See source 38.

(550)

1. The Greek title of this book indicates that it too consists largely of notes from the lectures of Ammonius Hermias. See Note 1 to source 529.

2. See source 41.

(553)

1. See source 42.

(554)

1. See source 42.

(555)

1. See source 43.

(556)

1. See source 43.

(557)

1. But see source 555.

(558)

1. See source 44.

2. But see source 527, and Note 3 there.

(564)

1. We have followed Ruelle's reconstruction of the word *azōnon* in this place. The manuscript reads the meaningless *azo*.

(566)

1. Compare source 60.

2. Asclepius takes the words "later in his activity" to mean "behind in his achievements." Compare source 295.

(568)

1. See source 61.

(570)

1. See source 61.

(571)

1. See source 61.

(572)

1. Compare source 62.
2. See source 3.

(575)

1. See source 63.

(576)

1. See source 63.

2. As opposed to Plato, who said that the stuff out of which the world is built is not. See Aristotle 988a25 ff.

(577)

1. See source 63.

(578)

1. See source 65.

(579)

1. See source 67.

(580)

1. See source 67.

(581)

1. See source 67.

(582)

1. See source 67.

(583)

1. See source 68.

(586)

1. See source 69.

(587)

1. See source 70.

(588)

1. See source 71.

(589)

1. Compare source 72.

(590)

1. See source 72.

(591)

1. See source 72.

(597)

1. 468/7–464/3 B.C.E.

(598)

1. See source 2.

(599)

1. Compare source 8.

(600)

1. See source 8.

(602)

1. See source 10.

(603)

1. See source 35.
2. I.e. a red-hot mass of ore.

(604)

1. See source 35.
2. I.e. 'aether'.
3. Literally "burning black wine."

(606)

1. See source 37.

(607)

1. See source 37.

(608)

1. See source 38.

(609)

1. See the first sentence of source 38.

(610)

1. See source 38.

(611)

1. See source 38.

(612)

1. See source 3.

(620)

1. Accepting the MS. reading *hen einai.*

2. This is Simplicius' interpretation of a phrase of the passage brought above, here lifted out of context.

3. This clause is not connected with what follows. Nor do we possess what precedes.

4. Viz. that there is another world, a world of intellectual distinctions corresponding to the distinctions in our world. The passage brought as further evidence refers to speeds greater than terrestrial speeds—a 'proof' that Anaxagoras must have imagined some world of pure thought.

(621)

1. This passage is part of a quotation from the lost commentary of Alexander of Aphrodisias on Aristotle's *Physics*. In 41.2 Simplicius makes it clear that he is quoting Alexander here.

(622)

1. This source is a comment on the passage "if the basic constituents of matter are infinite in number, then the infinitely numerous components must be either all of one kind, but of different shapes, as Democritus would have it, or else of different kinds of matter or even of matter having contrasting properties." (184b20–22)

2. And one kind of absolutely empty space, the void.

(623)

1. See source 17.

2. Referred to two sentences above as one of the two basic components in the universe. Simplicius has taken *hen kai polla*, 'a single undifferentiated material mass as well as many discrete objects' (see source 17), in its unspecific sense of 'a single one and a plurality of things.'

3. An expansion of, or commentary on, Aristotle's physical treatises, no longer extant. Compare source 619.

4. Sic! See *De Gen. et Corr.* 314b2 and following.

5. See source 17, end of first paragraph.

6. 184b22. See source 622, Note 1.

7. The Greek has the article, and reads, "*the* contrasting qualities," thus indicating the presence of all of them.

8. *Sc.* black and white.

9. Apparently Simplicius thought that this passage indicates a hierarchy of primary and secondary qualities in Anaxagoras' theory.

10. Other than what? Than the particles? In that case the reference would be to composite bodies. Other than Mind? In that case the reference would be to material bodies, as opposed to Mind. The sentence is out of context.

11. See pp. 369 and 374 (where Simplicius *In Phys.* 156.27–28 is mentioned), and p. 375f.

12. The text here is probably corrupt and certainly the sentence as it stands lacks a verb and is incomplete. Simplicius surely had *this* version of the text before him, since it illustrates his point well. The passage was brought as proof that Anaxagoras spoke of two orders; as it stands it presents a contrast between existence in the full sense and existence in the world of perception, between the surrounding medium—taken to be the realm of pure predicates in the Platonic sense—and the perceptible objects in the world of change, which are continually being assembled and taken apart.

(624)

1. See source 17.
2. See source 34.
3. We have taken *to ginesthai* in this passage to mean physical change and translated accordingly (see source 17). Simplicius wishes to make this meaning of the phrase explicit and adds *kai apollysthai* to give the full Greek phrase for physical change, "creation and destruction."

(625)

1. See source 17.

(626)

1. See source 17.

(627)

1. See source 17.

(628)

1. See source 17.
2. Literally "seed" (*sperma*).
3. In 187b20 (source 17) after "or bone" Alexander's manuscript reads "or particles of plants," as Simplicius tells us in what precedes.
4. Simplicius understands 'seed' (*sperma*) to mean 'that from which something grows,' instead of 'particle'.

(629)

1. See source 17.

(630)

1. See source 17.

(631)

1. See source 17.

(632)

1. See source 17.
2. While physical change is by definition change perceptible in nature.
3. Or 'infinite.'

(633)

1. See source 17.
2. See source 3.

(634)

1. See source 17.
2. Sic!

(635)

1. See source 17.
2. Cf. Nietzsche (77), who revived this interpretation in modern times.
3. Understood by Simplicius here to refer to pairs of contrasting qualities.

(638)

1. So that Aristotle should have included Anaxagoras after all.

(640)

1. See source 20.
2. See source 3.

(643)

1. See source 21.

(644)

1. See source 21.

(645)

1. See source 21.
2. I.e. when a flint gives off a spark, the flint remains unchanged when the spark is coming off; and when steam comes out of water, at any instant the volume of water does not visibly change.
3. Compare source 620, where a *threefold* order is spoken of.

(648)

1. See source 22.

(653)

1. See source 23.

(655)

1. So proving that air is a *body* perceptible to the touch, and not a void perceptible to the touch.

(656)

1. Cf. sources 655 and 657.

(660)

1. Compare source 24.

(661)

1. See source 24.

(662)

1. See source 24.

(664)

1. See source 25.

(665)

1. See source 25.

(666)

1. See source 25.

(667)

1. See source 25.
2. Compare sources 620 and 645.

(669)

1. See source 26.

(670)

1. See source 17, end.

(672)

1. Compare source 27.

(673)

1. See source 61.

(675)

1. See source 28.
2. Simplicius is here accepting Anaxagoras' etymology.

(682)

1. Compare source 29.

(683)

1. See source 29.

(684)

1. See source 29.

(686)

1. See source 30.

(688)

1. See source 31.

(689)

1. See source 32.

(690)

1. See source 32.

(691)

1. See source 32.
2. This last clause is Simplicius' comment on the words 'particles' (*spermata*) and 'features' (*ideas*) in the passage just quoted, as is clear from the Greek, where the word translated 'as in a mental pattern' is *spermatikōs*, and the phrase translated 'the way pure predicates are' is *kat' ideas*.

(695)

1. Compare source 689, which this directly contradicts.

(699)

1. See source 33.

(701)

1. See source 41.

(703)

1. See source 42.
2. Viz. Mind and life.

(704)

1. See source 43.
2. Simplicius here takes *apathēs*, translated 'not subject to change' in source 43, to mean 'free from properties.'

(705)

1. See source 44.

(706)

1. See source 45.

Footnotes to Part III

Chapter 1

1. Among the modern writers on Anaxagoras who have given special weight to Aristotle's testimony over and above all other testimony (with the exception of the so-called fragments) are: Meiners (71), Tiedemann (101), Carus (20), Brandis (12), Breier (13), Zeller (111), and Stace (97). Carus (p. 698) feels that where Aristotle conflicts with the testimony of the so-called fragments, Aristotle may be giving us a later version of Anaxagoras' theory, which represents a change of heart on Anaxagoras' part after his book was published. Breier (esp. p. 50 f.) gives a long argument defending the use of Aristotle as a primary source and extols Aristotle's wisdom and acumen. Stace (p. 98) notes that Aristotle was surely in a better position to know Anaxagoras' theory than is any modern scholar.

2. See especially Notes to source 89, and Chapter 5 of Part I.

Chapter 2

1. Brandis [12] concurs, as does Burnet [15], but both hasten to add that at least we are sure (from source 1) that there was a trial. (In later editions of his work Burnet took a more optimistic view of the situation and attempted to reconstruct many of the details of the trial from the data we have presented.) Freeman [46] prefers the version that Anaxagoras got away before the trial, since "The stories of a trial seem to be an embroidery of the facts, and perhaps an endeavour to bring Anaxagoras' fate into relation with that of Socrates" (p. 263). Another approach to the problem is taken by Carus [21] (p. 466), Hemsen [59] (pp. 25 ff.), and Davison [14], who find they can make almost all the data agree if they assume that there were two indictments separated by a number of years!

2. See the quote from Freeman [46] in Note 1 above.

Chapter 3

1. Simplicius' commentary on Aristotle's *Physics* (see Bibliography to the Sources) is referred to throughout this chapter as *In Phys.* The numbers refer to the Greek texts of the works quoted, brought in the Bibliography to the Sources.

2. Simplicius' commentary on Aristotle's *Astronomy* (see Bibliography to the Sources) is referred to throughout this chapter as *In De Caelo.*

3. In this chapter succeeding references to these collections will be accompanied only by the name of the editor(s) of the collection; e.g. references to Diels-Kranz (37) will appear as "Diels-Kranz."

4. For this reason, articles based on a minute, detailed study of the phraseology of the fragments, such as those by Deichgraeber (33), Gigon (49), and Mugler (75), appear to be singularly futile.

5. Additional evidence that the so-called fragments cannot provide a basis for understanding Anaxagoras' theory is the multitude of different expositions of his theory given by scholars who have depended mainly on these "quotations" (see Part III, Chapter 4, and compare the quotation brought there from Mates [69]). The wide divergence in the interpretations which specific "quotations" have undergone is mirrored in the various translations modern scholars have made of the "fragments." Those interested in comparing eccentric translations and interpretations of "fragments" are referred for Diels-Kranz fr. 1 to Tannery (98) p. 310, Cornford (28) pp. 24 and 26, Joehrens (61) p. 4 ff., Vlastos (105) p. 39, Note 36, Cleve (26) p. 47, Freeman (47) p. 83, Mugler (75) p. 375, and Gigon (49) pp. 7–8; for fr. 2 to Kirk and Raven (62) p. 382; for fr. 3 to Burnet (15) p. 285, Peck (79) p. 58, Ludvíkovsky (67) p. 162, Mugler (75) p. 324, and Reesor (84) p. 2; for fr. 4 to Carus (20) p. 707, Note, to Clemens (25) p. 42, Leon (66) *passim*, Cleve (26) pp. 13 and 14, Fraenkel (44), and (45) p. 293, Mugler (75) p. 376, and Gigon (49) p. 25; for fr. 5 to Joehrens (61) p. 27, Cleve (26) p. 10, and Freeman (47) p. 83; for fr. 6 to Zevort (112) p. 65, Arleth (2) p. 81, Tannery (98) p. 312, Peck (79) p. 58, Ludvíkovsky (67) p. 162, Joehrens (61) p. 12 ff., Freeman (47) p. 84, and Reesor (84) p. 3; for fr. 7 to Cleve (26) p. 46; for fr. 8 to Mugler (75) p. 325; for fr. 9 to Joehrens (61) p. 22 ff., and to Freeman (47) p. 84; for fr. 11 to Zevort (112) p. 61, and to Cleve (26) pp. 97–98; for fr. 12 to Breier (13) p. 77, Cornford (28) p. 85, Jaeger (60) p. 160, Joehrens (61) p. 42, Cleve (26) pp. 49, 19, and 27, and Capelle (19) *s.v.* Anaxagoras fr. 12; for fr. 13 to Joehrens (61) p. 55 ff., and Freeman (47) p. 85; for fr. 14 to Schorn (95) p. 41, Mullach (76) p. 250, Clemens (25) p. 58, Zevort (112) p. 91, Burnet (15) p. 285, Peck (79) p. 60, Capelle (19) *s.v.* Anaxagoras fr. 14, Freeman (47) p. 85, and Kirk and Raven (62) p. 374; for fr. 15 to Freeman (47) p. 85; for fr. 16 to Burnet (15) pp. 284 and 295, Joehrens (61) p. 26 ff., Freeman (47) p. 85, Kirk and Raven (62) p. 382, and Sambursky (90) p. 191.

Index

Items that are listed in the Table of Contents are not included in this Index. For example, we have not indexed the authors of the ancient sources on Anaxagoras (except for instances in which these authors are discussed elsewhere in the book).

In addition, we have not indexed the authors of the sources appearing in Part III, Chapter 2, although we have indexed the subjects discussed in that Chapter. The ancient sources listed and discussed in Part III, Chapter 2, and the pages on which they appear, are as follows:

(1) 338, 339, 348; (2) 339; (3) 332, 337, 342, 348; (7) 333; (9) 340, 345; (11) 336; (12) 335; (13) 333; (14) 338, 339; (15) 333; (16) 333; (20) 338; (21) 338; (22) 338; (23) 333; (27) 348; (28) 333; (29) 332, 333, 342; (31) 333; (35) 333; (36) 333; (37) 333; (39) 345, 349; (40) 340; (41) 333, 351; (43) 351; (48) 333; (51) 350; (52) 333; (53) 333; (54) 333; (55) 350; (57) 333; (61) 333; (62) 337; (80) 336; (81) 337; (82) 337; (83) 336; (84) 337; (85) 343; (86) 350, 351; (91) 333; (93) 333, 350; (95) 343; (96) 343; (98) 336; (99) 334; (101) 335; (104) 334; (105) 337; (106) 343, 353; (107) 335; (108) 333, 338, 341; (109) 350, 351; (113) 334; (115) 343; (116) 343; (117) 343; (118) 346; (119) 343; (120) 343; (121) 342; (123) 354; (124) 343; (126) 335; (127) 336; (129) 335; (130) 353; (131) 337; (132) 335; (133) 334; (134) 334, 353;(135) 340; (136) 343; (138) 349, 352; (139) 343; (141) 338, 343; (143) 338, 346; (144) 354; (145) 334; (146) 352; (149) 346; (150) 333; (151) 354; (154) 354; (155) 354; (156) 333; (157) 345, 346; (159) 334; (160) 335; (165) 341; (166) 333, 338, 339, 349; (167) 353; (168) 338, 339; (169) 352; (170) 333, 353; (171) 339; (172) 339; (173) 333; (174) 333, 340; (175) 340; (177) 350; (178) 352; (179) 343; (180) 351; (181) 352; (182) 350; (184) 333; (185) 353; (187) 333; (189) 352; (191) 334; (192) 334, 354; (193) 334; (194) 334, 335; (195) 346; (196) 338, 344, 349; (197) 346; (202) 334; (204) 343; (205) 335, 336, 337; (207) 334; (208) 334; (209) 342; (210) 334; (211) 354; (214) 333; (216) 342; (221) 341; (222) 333, 338, 349; (223) 338, 353; (224) 338; (225) 352; (226) 333, 353; (227) 339; (228) 339; (229) 333; (230) 333, 340; (231) 340; (232) 343; (234) 353; (236) 352, 353; (237) 351, 354; (247) 354; (248) 343; (251) 342; (253) 337, 349; (254) 336; (255) 351; (256) 353; (257) 354; (258) 345; (262) 345, 353; (263) 335; (265) 345; (266) 335; (268) 338, 339; (269) 343; (271) 332, 333, 338, 339, 340, 343, 345, 349, 350, 351, 352, 353, 354; (274) 350, 354; (275) 338; (277) 337; (279) 338; (283) 333; (284) 333; (285) 333; (286) 333; (287) 333; (291) 352; (292) 332, 350; (293) 333, 340; (299) 333; (337) 342; (340) 333, 334, 335, 336, 337, 338, 339 340, 341, 342, 343, 344, 345, 346, 350, 352, 353, 354; (341) 342; (342) 342, 347; (343) 342, 347; (344) 343; (349) 353; (350) 354; (355) 338; (356) 336; (357) 336; (358) 336; (366) 336; (369) 334, 337, 342, 343; (370) 336; (372) 335, 338, 347; (377) 352; (379) 333, 349; (380) 341; (381) 353; (382) 339; (383) 353; (387) 339; (388) 336; (391) 334; (396) 345, 350; (397) 344; (398) 344, 345; (399) 354; (408) 338; (411) 333; (415) 333; (416) 333; (422) 333; (425) 333; (428) 333; (432) 354; (433) 333, 354; (434) 342; (435) 339, 347; (438) 333, 338; (440) 339, 347; (445) 352; (446) 345; (447) 342; (450) 339, 349; (453) 352; (455) 339; (456) 351; (457) 342; (459) 337; (463) 338; (465) 334; (466) 338; (469) 345; (477) 352; (478) 341; (482) 333, 339,

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